Cisco XR 12000 Series Router SIP and SPA Hardware Installation Guide

June 2008

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

Text Part Number: OL-9175-05

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The following information is for FCC compliance of Class A devices: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

The following information is for FCC compliance of Class B devices: The equipment described in this manual generates and may radiate radio-frequency energy. If it is not installed in accordance with Cisco's installation instructions, it may cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in part 15 of the FCC rules. These specifications are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

Modifying the equipment without Cisco's written authorization may result in the equipment no longer complying with FCC requirements for Class A or Class B digital devices. In that event, your right to use the equipment may be limited by FCC regulations, and you may be required to correct any interference to radio or television communications at your own expense.

You can determine whether your equipment is causing interference by turning it off. If the interference stops, it was probably caused by the Cisco equipment or one of its peripheral devices. If the equipment causes interference to radio or television reception, try to correct the interference by using one or more of the following measures:

• Turn the television or radio antenna until the interference stops.

• Move the equipment to one side or the other of the television or radio.

• Move the equipment farther away from the television or radio.

• Plug the equipment into an outlet that is on a different circuit from the television or radio. (That is, make certain the equipment and the television or radio are on circuits controlled by different circuit breakers or fuses.)

Modifications to this product not authorized by Cisco Systems, Inc. could void the FCC approval and negate your authority to operate the product.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

CCDE, CCENT, Cisco Eos, Cisco Lumin, Cisco Nexus, Cisco StadiumVision, the Cisco logo, DCE, and Welcome to the Human Network are trademarks; Changing the Way We Work, Live, Play, and Learn is a service mark; and Access Registrar, Aironet, AsyncOS, Bringing the Meeting To You, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, CCVP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Collaboration Without Limitation, EtherFast, EtherSwitch, Event Center, Fast Step, Follow Me Browsing, FormShare, GigaDrive, HomeLink, Internet Quotient, IOS, iPhone, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, iQuick Study, IronPort, the IronPort logo, LightStream, Linksys, MediaTone, MeetingPlace, MGX, Networkers, Networking Academy, Network Registrar, PCNow, PIX, PowerPanels, ProConnect, ScriptShare, SenderBase, SMARTnet, Spectrum Expert, StackWise, The Fastest Way to Increase Your Internet Quotient, TransPath, WebEx, and the WebEx logo are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0805R)

Any Internet Protocol (IP) addresses used in this document are not intended to be actual addresses. Any examples, command display output, and figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses in illustrative content is unintentional and coincidental.

Cisco XR 12000 Series Router SIP and SPA Hardware Installation Guide
© 2008 Cisco Systems, Inc. All rights reserved.

CONTENTS

Preface xvii

Document Change History xvii

Objectives xix

Organization xix

Related Documentation xix

Obtaining Documentation and Submitting a Service Request xx

CHAPTER 1 **Overview: Cisco XR 12000 Series Router SPA Interface Processors** 1-1

SIP and SPA Compatibility 1-1

Router Hardware Installation 1-2

Supported Platforms 1-2

SIP Summary 1-4

SIP Software and Hardware Compatibility 1-4

Cisco XR 12000 SIP-600 Overview 1-5

Cisco XR 12000 SIP-600 Board Components 1-5

Cisco XR 12000 SIP-600 LEDs 1-6

Cisco XR 12000 SIP-600 Physical Specifications 1-6

SPA Subslot Numbering on the Cisco XR 12000 SIP-600 1-6

SPA Interface Addresses on the Cisco XR 12000 SIP-600 1-7

Cisco XR 12000 SIP-401 Overview 1-8

Cisco XR 12000 SIP-401 Board Components 1-9

Cisco XR 12000 SIP-401 LEDs 1-9

Cisco XR 12000 SIP-401 Physical Specifications 1-10

SPA Slot Numbering on the Cisco XR 12000 SIP-401 1-10

SPA Interface Addresses on the Cisco XR 12000 SIP-401 1-11

Cisco XR 12000 SIP-501 Overview 1-12

Cisco XR 12000 SIP-501 Board Components 1-12

Cisco XR 12000 SIP-501 LEDs 1-12

Cisco XR 12000 SIP-501 Physical Specifications 1-13

SPA Subslot Numbering on the Cisco XR 12000 SIP-501 1-13

SPA Interface Addresses on the Cisco XR 12000 SIP-501 1-14

Cisco XR 12000 SIP-601 Overview 1-15

Cisco XR 12000 SIP-601 Board Components 1-15

Cisco XR 12000 SIP-601 LEDs 1-15

Cisco XR 12000 SIP-601 Physical Specifications 1-16
SPA Subslot Numbering on the Cisco XR 12000 SIP-601 1-16
SPA Interface Addresses on the Cisco XR 12000 SIP-601 1-17

CHAPTER 2 **Overview: Cisco XR 12000 Series Router Shared Port Adaptors** 2-1

SPA Summary 2-2
Checking Hardware and Software Compatibility 2-3
Bandwidth Oversubscription 2-3
2-Port and 4-Port T3/E3 Serial SPA Overview 2-4
2-Port and 4-Port Clear Channel T3/E3 SPA LEDs 2-4
2-Port and 4-Port Clear Channel T3/E3 SPA Interface Specifications 2-5
2-Port and 4-Port Clear Channel T3/E3 SPA Cables and Connectors 2-6
2-Port and 4-Port Channelized T3 to DS0 SPA Overview 2-6
2-Port and 4-Port Channelized T3 SPA LEDs 2-7
2-Port and 4-Port Channelized T3 SPA Interface Specifications 2-7
2-Port and 4-Port Channelized T3 SPA Cables and Connectors 2-8
8-Port Channelized T1/E1 SPA Overview 2-8
8-Port Channelized T1/E1 SPA LEDs 2-9
8-Port Channelized T1/E1 SPA Interface Specifications 2-9
8-Port Channelized T1/E1 SPA Cables, Connectors, and Pinouts 2-10
8 Port FastEthernet SPA Overview 2-10
8-Port FastEthernet SPA LEDs 2-11
8-Port FastEthernet SPA Cables, Connectors, and Pinouts 2-11
1 Port 10-Gigabit Ethernet SPA Overview 2-13
1-Port 10-Gigabit Ethernet SPA LEDs 2-13
1-Port 10-Gigabit Ethernet SPA XFP Optical Transceiver Modules, Connectors, and Cables 2-14
XFP Connections 2-14
XFP Port Cabling Specifications 2-15
2-Port Gigabit Ethernet SPA Overview 2-15
2-Port Gigabit Ethernet SPA LEDs 2-16
2-Port Gigabit Ethernet SPA (Version 2) LEDs 2-16
2-Port Fast Ethernet SPA Cables, Connectors, and Pinouts 2-17
2-Port Gigabit Ethernet SPA Cables and Connectors 2-18
SFP Module Connections 2-18
SFP Module Cabling and Connection Equipment 2-20
5-Port Gigabit Ethernet SPA Overview 2-21
5-Port Gigabit Ethernet SPA LEDs 2-21
5-Port Gigabit Ethernet SPA Cables and Connectors 2-22
SFP Module Connections 2-22

SFP Module Cabling and Connection Equipment 2-24
10-Port Gigabit Ethernet SPA Overview 2-25
10-Port Gigabit Ethernet SPA LEDs 2-26
10-Port Gigabit Ethernet SPA Cables and Connectors 2-26
SFP Module Connections 2-26
SFP Module Cabling and Connection Equipment 2-28
1-Port Channelized STM-1/OC-3 SPA Overview 2-29
1-Port Channelized STM-1/OC-3 SPA LEDs 2-30
1-Port Channelized STM-1/OC-3 SPA Interface Specifications 2-30
1-Port Channelized STM-1/OC-3 SPA Cables and Connectors 2-31
1-Port Channelized STM-4/OC-12 SPA Overview 2-32
1-Port Channelized STM-4/OC-12 SPA LEDs 2-32
1-Port Channelized STM-4/OC-12 SPA Interface Specifications 2-33
1-Port Channelized STM-4/OC-12 SPA Cables and Connectors 2-33
1-Port Channelized STM-16/OC-48 SPA Overview 2-34
1-Port Channelized STM-16/OC-48 SPA LEDs 2-34
1-Port Channelized STM-16/OC-48 SPA Interface Specifications 2-35
1-Port Channelized STM-16/OC-48 SPA Cables and Connectors 2-35
1-Port OC-192/STM-64 POS SPA Overview 2-37
1-Port OC-192/STM-64 POS/RPR SPA LEDs 2-37
1-Port OC-192/STM-64 POS/RPR SPA Interface Specifications 2-38
1-Port OC-192/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables 2-39
Mate Interface Cables 2-39
1-Port OC-192 STM-64 POS RPR XFP SPA Overview 2-40
1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs 2-41
1-Port OC-192/STM-64 POS/RPR XFP SPA Interface Specifications 2-42
1-Port OC-192/STM-64 POS/RPR XFP SPA Optical Transceiver Modules, Connectors, and Cables 2-42
OC-192 Module Connections 2-43
Mate Interface Cables 2-44
4-Port OC-3/STM-1 POS SPA Overview 2-44
2-Port and 4-Port OC-3/STM-1 POS SPA LEDs 2-45
2-Port and 4-Port OC-3/STM-1 POS SPA Interface Specifications 2-46
2-Port and 4-Port OC-3/STM-1 POS SPA Optical Transceiver Modules and Cables 2-46
OC-3 Module Connections 2-48
8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Overview 2-49
8-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs 2-49
8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Interface Specifications 2-50
8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Optical Transceiver Modules and Cables 2-50

OC-3 Module Connections 2-52
OC-12 Module Connections 2-53
1-Port OC-12/STM-4 POS SPA Overview 2-54
1-Port OC-12/STM-4 POS SPA LEDs 2-54
1-Port OC-12/STM-4 POS SPA Interface Specifications 2-55
1-Port OC-12/STM-4 POS SPA SFP Optical Transceiver Modules and Cables 2-55
1-Port OC-48/STM-16 POS SPA Overview 2-57
1-Port OC-48/STM-16 POS SPA LEDs 2-57
1-Port OC-48/STM-16 POS SPA Interface Specifications 2-58
1-Port OC-48/STM-16 POS SPA Optical Transceiver Modules, Connectors, and Cables 2-59
Mate Interface Cables 2-59
2-Port and 4-Port OC-48/STM-16 POS SPA Overview 2-60
2-Port and 4-Port OC-48/STM-16 POS SPA LEDs 2-61
2-Port and 4-Port OC-48/STM-16 POS SPA Interface Specifications 2-62
2-Port and 4-Port OC-48/STM-16 POS SPA Cables, Optical Transceiver Modules, and Connectors 2-62
OC-48 Module Connections 2-63
Mate Interface Cables 2-63
2-Port OC-48 POS RPR SPA Overview 2-64
2-Port OC48-POS/RPR SPA LEDs 2-64
2-Port OC48-POS/RPR SPA Interface Specifications 2-66
2-Port OC48-POS/RPR SPA Cables, Optical Transceiver Modules, and Connectors 2-66
Cisco XR 12000 IPSec VPN SPA Overview 2-66
Cisco XR 12000 IPSec VPN SPA LEDs 2-67
1-Port and 3-Port Clear Channel OC-3 ATM SPA Overview 2-68
1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs 2-68
1-Port and 3-Port Clear Channel OC-3 ATM SPA Interface Specifications 2-69
1-Port and 3-Port Clear Channel OC-3 ATM SPA Cables and Connectors 2-69
1-Port Clear Channel OC-12 ATM SPA Overview 2-70
1-Port Clear Channel OC-12 ATM SPA LEDs 2-70
1-Port Clear Channel OC-12 ATM SPA Interface Specifications 2-71
1-Port Clear Channel OC-12 ATM SPA Cables and Connectors 2-72
2-Port Channelized T3/E3 ATM CEoP SPA Overview 2-73
2-Port Channelized T3/E3 ATM CEoP SPA LEDs 2-73
2-Port Channelized T3/E3 ATM CEoP SPA Interface Specifications 2-74
2-Port Channelized T3/E3 ATM CEoP SPA Cables and Connectors 2-74

CHAPTER 3 **Preparing to Install a Shared Port Adapter or a SPA Interface Processor** 3-1
Safety Guidelines 3-1

Safety Warnings 3-1
Electromagnetic Compatibility Regulatory Statements 3-2
Electrical Equipment Guidelines 3-2
Telephone Wiring Guidelines 3-2
Laser/LED Safety 3-2
Preventing Electrostatic Discharge 3-3
Required Tools and Equipment 3-4

CHAPTER 4 **Installing and Removing a SPA Interface Processor** 4-1
Handling SIPs 4-1
Removing and Installing a SIP 4-2
Guidelines for SIP Removal and Installation 4-2
Removing a SIP 4-3
Installing a SIP 4-5

CHAPTER 5 **Installing and Removing a Shared Port Adapter** 5-1
Handling SPAs 5-1
Online Insertion and Removal 5-2
SPA Installation and Removal 5-2
Optical Device Installation and Removal 5-3
Cleaning Optical Devices 5-3
Checking the Installation 5-4
Verifying the Installation 5-4
Using show Commands to Verify SIP and SPA Status 5-5
Using show Commands to Display SPA Information 5-5
Using the ping Command to Verify Network Connectivity 5-8

CHAPTER 6 **Troubleshooting the Installation** 6-1
Troubleshooting the SIP 6-1
Using debug Commands 6-1
Packing a SIP for Shipment 6-2
Packing a SPA for Shipment 6-3

INDEX

FIGURES

Figure 1-1 Cisco XR 12000 SIP-600 Board—Rear View **1-5**

Figure 1-2 Cisco XR 12000 SIP-600 Face Plate **1-6**

Figure 1-3 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA **1-7**

Figure 1-4 Slot, Subslot, and Port Locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA. **1-8**

Figure 1-5 Cisco XR 12000 SIP-401 Board—Rear View **1-9**

Figure 1-6 Cisco XR 12000 SIP-401 Face Plate **1-9**

Figure 1-7 Cisco XR 12000 SIP-401 with SPAs Installed **1-10**

Figure 1-8 Cisco 12000 Series Router with Cisco XR 12000 SIP-401 Installed **1-11**

Figure 1-9 Cisco XR 12000 SIP-501 Board—Rear View **1-12**

Figure 1-10 Cisco XR 12000 SIP-501 Face Plate **1-12**

Figure 1-11 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA **1-13**

Figure 1-12 Slot, Subslot, and Port Locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA. **1-14**

Figure 1-13 Cisco XR 12000 SIP-601 Board—Rear View **1-15**

Figure 1-14 Cisco XR 12000 SIP-601 Face Plate **1-16**

Figure 1-15 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA **1-17**

Figure 1-16 Slot, Subslot, and Port Locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA. **1-18**

Figure 2-1 4-Port Clear Channel T3/E3 SPA Faceplate **2-5**

Figure 2-2 4-Port Channelized T3 SPA Faceplate **2-7**

Figure 2-3 8-Port Channelized T1/E1 SPA Faceplate **2-9**

Figure 2-4 RJ-45 Connector **2-10**

Figure 2-5 8-Port FastEthernet SPA Faceplate **2-11**

Figure 2-6 RJ-45 Connections, Plug, and Receptacle **2-12**

Figure 2-7 Straight-Through Cable Pinout, RJ-45 Connection to a Hub or Repeater **2-12**

Figure 2-8 Crossover Cable Pinout, RJ-45 Connections Between Routers **2-13**

Figure 2-9 1-Port 10-Gigabit Ethernet SPA Faceplate **2-13**

Figure 2-10 LC-Type Cable for the XFP Optical Transceiver Modules **2-14**

Figure 2-11 XFP Illustration **2-15**

Figure 2-12 2-Port Gigabit Ethernet SPA Faceplate **2-16**

Figure 2-13 2-Port Gigabit Ethernet SPA (Version 2) Faceplate **2-16**
Figure 2-14 2-Port Fast Ethernet RJ-45 Connections, Plug, and Receptacle **2-17**
Figure 2-15 5-Port Gigabit Ethernet SPA Faceplate **2-22**
Figure 2-16 10-Port Gigabit Ethernet SPA Faceplate **2-26**
Figure 2-17 1-Port Channelized STM-1/OC-3 SPA Faceplate **2-30**
Figure 2-18 SFP Optics Module **2-31**
Figure 2-19 LC Type Cables **2-31**
Figure 2-20 1-Port Channelized STM-4/OC-12 SPA Faceplate **2-32**
Figure 2-21 SFP Optics Module **2-33**
Figure 2-22 LC Type Cables **2-34**
Figure 2-23 1-Port Channelized STM-16/OC-48 SPA Faceplate **2-34**
Figure 2-24 SFP Optics Module **2-36**
Figure 2-25 LC Type Cables **2-36**
Figure 2-26 1-Port OC-192/STM-64 POS/RPR SPA Faceplate **2-37**
Figure 2-27 SC-Type Connectors for the Fixed Optical Transceivers **2-39**
Figure 2-28 SPA Mate Cables **2-40**
Figure 2-29 1-Port OC-192/STM-64 POS/RPR XFP SPA Faceplate **2-41**
Figure 2-30 LC-Type Cable for the XFP Optical Transceiver Modules **2-43**
Figure 2-31 SPA Mate Cables **2-44**
Figure 2-32 4-Port OC-3/STM-1 POS SPA Faceplate **2-45**
Figure 2-33 SFP Optics Module **2-47**
Figure 2-34 LC-Type Cable **2-47**
Figure 2-35 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Faceplate **2-49**
Figure 2-36 SFP Optics Module **2-51**
Figure 2-37 LC-Type Cable **2-52**
Figure 2-38 1-Port OC-12/STM-4 POS SPA Faceplate **2-54**
Figure 2-39 SFP Optics Module **2-56**
Figure 2-40 LC-Type Cable **2-57**
Figure 2-41 1-Port OC-48/STM-16 POS SPA Faceplate **2-57**
Figure 2-42 LC-Type Cable for the SFP Optical Transceiver Modules **2-59**
Figure 2-43 SPA Mate Cables **2-60**
Figure 2-44 2-Port OC-48 POS/RPR SPA Faceplate **2-61**
Figure 2-45 LC-Type Cable **2-62**
Figure 2-46 SPA Mate Cables **2-64**
Figure 2-47 2-Port OC48-POS/RPR SPA Faceplate **2-65**

Figure 2-48 Duplex Patch Cable with LC-Type Connectors **2-66**
Figure 2-49 Cisco XR 12000 IPSec VPN SPA Faceplate **2-67**
Figure 2-50 1-Port and 3-Port Clear Channel OC-3 ATM SPA Faceplate **2-68**
Figure 2-51 SFP Optics Module **2-69**
Figure 2-52 Duplex Patch Cable with LC-Type Connectors **2-70**
Figure 2-53 1-Port Clear Channel OC-12 ATM SPA Faceplate **2-71**
Figure 2-54 SFP Optics Module **2-72**
Figure 2-55 Duplex Patch Cable with LC-Type Connectors **2-73**
Figure 2-56 2-Port Channelized T3/E3 ATM CEoP SPA Faceplate **2-73**
Figure 3-1 Laser Warning Labels for Single-Mode Port **3-3**
Figure 3-2 Class 1 LED Warning Label for Multimode Port **3-3**
Figure 4-1 Handling a SIP **4-2**
Figure 4-2 SIP Removal and Installation **4-4**
Figure 4-3 Ejector Levers **4-5**
Figure 5-1 Handling a SPA **5-1**
Figure 5-2 SPA Installation and Removal **5-3**

TABLES

Table 1 Document Change History Table **1-xvii**
Table 1-1 SIP and SPA Compatibility on the Cisco XR 12000 Series Router **1-1**
Table 1-2 SIP Summary **1-4**
Table 1-3 SIP Hardware and Software Compatibility **1-4**
Table 1-4 Cisco XR 12000 SIP-600 LEDs **1-6**
Table 1-5 Cisco XR 12000 SIP-600 Physical Specifications **1-6**
Table 1-6 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA **1-7**
Table 1-7 Slot and Port Locations for the 1-Port 10-Gigabit Ethernet SPA **1-8**
Table 1-8 Cisco XR 12000 SIP-401 LED **1-9**
Table 1-9 Cisco XR 12000 SIP-401 Physical Specifications **1-10**
Table 1-10 Cisco XR 12000 SIP-501 LEDs **1-13**
Table 1-11 Cisco XR 12000 SIP-501 Physical Specifications **1-13**
Table 1-12 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA **1-14**
Table 1-13 Slot and Port Locations for the 1-Port 10-Gigabit Ethernet SPA **1-15**
Table 1-14 Cisco XR 12000 SIP-601 LEDs **1-16**
Table 1-15 Cisco XR 12000 SIP-601 Physical Specifications **1-16**
Table 1-16 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA **1-17**
Table 1-17 Slot and Port Locations for the 1-Port 10-Gigabit Ethernet SPA **1-18**
Table 2-1 Supported SPAs on Cisco XR 12000 Series Routers **2-2**
Table 2-2 SPA Bandwidth Capacity **2-3**
Table 2-3 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs **2-5**
Table 2-4 2-Port and 4-Port Clear Channel T3/E3 SPA Connectors **2-6**
Table 2-5 2-Port and 4-Port Channelized T3 SPA LEDs **2-7**
Table 2-6 2-Port and 4-Port Channelized T3 SPA Connectors **2-8**
Table 2-7 8-Port Channelized T1/E1 SPA LEDs **2-9**
Table 2-8 RJ-45 Connector Pinouts **2-10**
Table 2-9 8-Port FastEthernet SPA LEDs **2-11**
Table 2-10 RJ-45 Connector Pinout **2-12**
Table 2-11 1-Port 10-Gigabit Ethernet SPA LEDs **2-13**
Table 2-12 XFP Port Cabling Specifications **2-15**

Table 2-13 2-Port Gigabit Ethernet SPA LEDs **2-16**
Table 2-14 2-Port Gigabit Ethernet SPA (Version 2) LEDs **2-17**
Table 2-15 2-Port Fast Ethernet RJ-45 Connector Pinouts **2-18**
Table 2-16 SFP Module Options **2-18**
Table 2-17 SFP Module Specifications **2-19**
Table 2-18 SFP Module Port Cabling Specifications **2-20**
Table 2-19 5-Port Gigabit Ethernet SPA LEDs **2-22**
Table 2-20 SFP Module Options **2-23**
Table 2-21 SFP Module Specifications **2-23**
Table 2-22 SFP Module Port Cabling Specifications **2-24**
Table 2-23 10-Port Gigabit Ethernet SPA LEDs **2-26**
Table 2-24 SFP Module Options **2-27**
Table 2-25 SFP Module Specifications **2-27**
Table 2-26 SFP Module Port Cabling Specifications **2-29**
Table 2-27 1-Port Channelized STM-1/OC-3 SPA LEDs **2-30**
Table 2-28 1-Port Channelized STM-4/OC-12 SPA LEDs **2-32**
Table 2-29 1-Port Channelized STM-16/OC-48 SPA LEDs **2-35**
Table 2-30 1-Port OC-192/STM-64 POS/RPR SPA LEDs **2-38**
Table 2-31 1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs **2-41**
Table 2-32 OC-192 Specifications **2-43**
Table 2-33 2-Port and 4-Port OC-3/STM-1 POS SPA LEDs **2-45**
Table 2-34 OC-3 Specifications **2-48**
Table 2-35 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs **2-50**
Table 2-36 OC-3 Specifications **2-52**
Table 2-37 OC-12 Specifications **2-53**
Table 2-38 1-Port OC-12/STM-4 POS SPA LEDs **2-55**
Table 2-39 1-Port OC-48/STM-16 POS SPA LEDs **2-58**
Table 2-40 2-Port and 4-Port OC-48/STM-16 POS SPA LEDs **2-61**
Table 2-41 OC-48 Specifications **2-63**
Table 2-42 2-Port OC48-POS/RPR SPA LEDs **2-65**
Table 2-43 Cisco XR 12000 IPSec VPN SPA LED **2-67**
Table 2-44 1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs **2-68**
Table 2-45 1-Port Clear Channel OC-12 ATM SPA LEDs **2-71**
Table 2-46 2-Port Channelized T3/E3 ATM CEoP SPA LEDs **2-74**
Table 2-47 2-Port Channelized T3/E3 ATM CEoP SPA Connectors **2-75**

Table 5-1 show Commands to Display SPA Information **5-6**

Table 5-2 show Commands to Display SPA Information **5-6**

Preface

Revised: June 2008, OL-9175-05

This preface describes the objectives and organization of this document and explains how to find additional information on related products and services. This preface contains the following sections:

- Document Change History, page xvii
- Objectives, page xix
- Organization, page xix
- Related Documentation, page xix
- Obtaining Documentation and Submitting a Service Request, page xx

Document Change History

Table 1 provides a list of the changes to this document.

Table 1 Document Change History Table

Release No.	Revision	Date	Change Summary
3.7.0	Rev. E0	June 30, 2008	Provides descriptions and installation instructions for the following SPAs: • 1-Port and 3-Port Clear Channel OC-3 ATM SPA • 1-Port Clear Channel OC-12 ATM SPA • 2-Port Channelized T3/E3 ATM CEoP SPA
3.6.0	Rev. D1	November 19, 2007	Provides descriptions and installation instructions for the following SPAs: • 8-Port Channelized T1/E1 SPA • 1-Port Channelized STM-16/OC-48 SPA

Table 1 Document Change History Table

Release No.	Revision	Date	Change Summary
3.5.1	Rev. C1	October 24, 2007	Provides descriptions and installation instructions for the following SPAs: • 4-port OC3/STM4 POS SPA • 8-port OC3/STM4 POS SPA • 2-port OC12/STM4 POS SPA • 4-port OC12/STM4 POS SPA • 8-port OC12/STM4 POS SPA • 1-port OC48/STM16 POS/RPR SPA • 1-port Channelized OC12 to DS0 SPA • 1-port Channelized OC48 to DS3 SPA • 1-port Channelized STM1/OC3 to DS0 SPA
3.4.1	Rev. B1	January 31, 2007	Provides descriptions and installation instructions for the following SPA: • 2-Port Gigabit Ethernet SPA (SPA-2X1GE-V2)
3.4.0	Rev. B0	October 30, 2006	Provides descriptions and installation instructions for the following SPAs: • 8-Port Fast Ethernet SPA (SPA-8X1FE-TX-V2) • 1-Port 10-Gigabit Ethernet SPA (SPA-1X10GE-L-V2) • 5-Port Gigabit Ethernet SPA (SPA-5x1GE-V2) • 10-Port Gigabit Ethernet SPA (SPA-10X1GE-V2)
3.3	Rev. A1	May 15, 2006	Provides descriptions and installation instructions for the following SIPs and SPAs: • Cisco XR 12000 SIP-401 • Cisco XR 12000 SIP-501 • Cisco XR 12000 SIP-601 • 2-Port and 4-Port Channelized T3 SPA • 2-Port and 4-Port Clear Channel T3/E3 SPA • 8-Port FastEthernet SPA • 2-Port OC-48 POS/RPR SPA
3.2	Rev. A0	April 14, 2005	Initial release and 1st publication. Provides descriptions and installation instructions for the following SIPs and SPAs: • Cisco XR 12000 SIP-600 • 1-Port 10-Gigabit Ethernet SPA • 5-Port Gigabit Ethernet SPA • 10-Port Gigabit Ethernet SPA • 1-Port OC-192/STM-64 POS/RPR SPA

Objectives

This document describes the shared port adaptors (SPAs) and SPA Interface Processors (SIPs) that are supported on Cisco XR 12000 series routers. This document also describes how to install the supported SIPs and SPAs and how to troubleshoot the installation.

Organization

This document contains the following chapters:

Section	Title	Description
Chapter 1	Overview: Cisco XR 12000 Series Router SPA Interface Processors	Provides a SIP/SPA compatibility summary. For each supported SIP, provides a summary of SIP characteristics and a SIP overview.
Chapter 2	Overview: Cisco XR 12000 Series Router Shared Port Adaptors	For each supported SPA, provides a summary of SPA characteristics and a SPA overview.
Chapter 3	Preparing to Install a Shared Port Adapter or a SPA Interface Processor	Describes the required tools, equipment, and safety guidelines for installing SIPs and SPAs.
Chapter 4	Installing and Removing a SPA Interface Processor	Describes the procedures for installing and removing a SIP on a Cisco 12000 Series Router.
Chapter 5	Installing and Removing a Shared Port Adapter	Describes the procedures for installing and removing a SPA on a Cisco 12000 Series Router. It also describes how to verify the SIP and SPA installation.
Chapter 6	Troubleshooting the Installation	Provides information for troubleshooting the installation of SIPs and SPAs.

Related Documentation

This section refers you to other documentation that also might be useful as you configure your Cisco XR 12000 series router. The documentation listed below is available online.

- *Cisco IOS XR Getting Started Guide*
- *Cisco IOS XR Configuration Guides and Command Reference*
- *Cisco IOS XR Command Modes Reference*
- *Cisco IOS XR Diagnostics*
- *Cisco IOS XR Software Craft Works Interface Guide*
- *Cisco IOS XR XML API Guide*
- *Cisco IOS XR ROM Monitor Guide*
- *Upgrading from Cisco IOS to Cisco IOS XR Software on the Cisco 12000 Series Router*
- *Converting Cisco IOS Configurations to Cisco IOS XR Configurations*
- *Cisco IOS XR Security Guide*

- *Cisco IOS XR System Error Message Reference Guide*
- *Cisco IOS XR 12xxx Router Chassis Installation Guide*
- *Release Notes for Cisco IOS XR Software*
- *Regulatory Compliance and Safety Information for Cisco XR 12000 Series Routers*

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

Subscribe to the *What's New in Cisco Product Documentation* as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS version 2.0.

CHAPTER 1

Overview: Cisco XR 12000 Series Router SPA Interface Processors

Revised: June 2008, OL-9175-05

This chapter describes the SPA interface processors (SIPs) that are supported on the Cisco XR 12000 Series Router and contains the following sections:

- SIP and SPA Compatibility, page 1-1
- Router Hardware Installation, page 1-2
- SIP Software and Hardware Compatibility, page 1-4
- Cisco XR 12000 SIP-600 Overview, page 1-5
- Cisco XR 12000 SIP-401 Overview, page 1-8
- Cisco XR 12000 SIP-501 Overview, page 1-12
- Cisco XR 12000 SIP-601 Overview, page 1-15

SIP and SPA Compatibility

Table 1-1 shows the SPAs that are supported on the Cisco XR 12000 Series Router and the SIPs that support them:

Table 1-1 SIP and SPA Compatibility on the Cisco XR 12000 Series Router

SPA	**SIP 401**	**SIP 501**	**SIP 601**	**SIP 600**
2-Port T3/E3 Serial SPA	X	X	X	
8-Port Channelized T1/E1 SPA	X	X	X	
4-Port Clear Channel T3/E3 SPA	X	X	X	
2-Port Channelized T3 SPA	X	X	X	
4-Port Channelized T3 SPA	X	X	X	
8-Port FastEthernet SPA	X	X	X	
1-Port 10-Gigabit Ethernet SPA			X	X
2-Port Gigabit Ethernet SPA	X	X	X	

Table 1-1 SIP and SPA Compatibility on the Cisco XR 12000 Series Router (continued)

SPA	SIP 401	SIP 501	SIP 601	SIP 600
5-Port Gigabit Ethernet SPA		X	X	X
10-Port Gigabit Ethernet SPA			X	X
1-Port Channelized OC-3/STM-1 SPA	X	X	X	
2-Port OC48-POS/RPR SPA		X	X	X
2-Port and 4-Port OC-48/STM-16 POS SPA			X	
1-Port OC-192/STM-64 POS/RPR SPA			X	X
4-port OC3/STM1 POS SPA	X	X	X	
8-port OC3/STM1 POS SPA	X	X	X	
2-port OC12/STM4 POS SPA	X	X	X	
4-port OC12/STM4 POS SPA	X	X	X	
8-port OC12/STM4 POS SPA		X	X	
IPSec VPN SPA	X	X	X	
1-Port Clear Channel OC-3 ATM SPA	X	X	X	
3-Port Clear Channel OC-3 ATM SPA	X	X	X	
1-Port Clear Channel OC-12 ATM SPA	X	X	X	
2-Port Channelized T3/E3 ATM CEoP SPA	X	X	X	

Router Hardware Installation

For Cisco XR 12000 Series Router hardware installation and configuration information, refer to the installation and configuration guide for your router. The guide includes information on the router switch fabric and how it affects the operation of SIPs, as well as SIP slot locations, slot width, and other requirements.

Note References to line cards in the router hardware installation and configuration guides apply equally to SIPs.

Supported Platforms

SIPs are supported on all Cisco XR 12000 Series Routers. The 2.5G ISE SIP is supported on the Cisco 12016, 124xx, and 128xx routers. The Cisco XR 12000 SIP-401, the Cisco XR 12000 SIP-501, the Cisco XR 12000 SIP-600, and the Cisco XR 12000 SIP-601 are supported on the Cisco 124xx and 128xx routers.

Note To support the requirements of this line card, the Cisco XR 12000 Series Router must have at least one clock and scheduler card (CSC) installed. For additional information, refer to the installation and configuration guide for your Cisco XR 12000 Series Router.

SIP Summary

Summary descriptions of all SIPs supported on the Cisco XR 12000 Series Router are shown in Table 1-2.

Table 1-2 SIP Summary

SIP	Product Number	Description	Number of Supported SPAs	Engine Type
Cisco XR 12000 SIP-600	12000-SIP-600	10G Engine 5 SPA Interface Processor	2 single-width, double-height 2 single-width, single-height[1] 1 dual-width, double-height[2]	Engine 5
Cisco XR 12000 SIP-401	12000-SIP-401	2.5G Engine 5 SPA Interface Processor	2 single-width, double-height 2 single-width, single-height 1 dual-width, double-height	Engine 5
Cisco XR 12000 SIP-501	12000-SIP-501	5G Engine 5 SPA Interface Processor	2 single-width, double-height 2 single-width, single-height 1 dual-width, double-height	Engine 5
Cisco XR 12000 SIP-601	12000-SIP-601	10G Engine 5 SPA Interface Processor	2 single-width, double-height 4 single-width, single-height 1 dual-width, double-height	Engine 5

1. Requires that a blank module filler plate be installed in the bottom subslot.
2. Requires the removal of the central septum between the SPA subslots.

SIP Software and Hardware Compatibility

For software configuration information, refer to the Cisco IOS XR software configuration and command reference publications for the installed Cisco IOS XR release. Also refer to the Cisco IOS XR software release notes for additional information. Table 1-3 lists the Cisco IOS XR releases that are compatible with supported SIPs.

To ensure compatibility with the software, your SIPs should have a specific hardware revision number. The number is printed on a label affixed to the component side of the card. The hardware revision number can be displayed by using the **show diags** *slot-number* command. Table 1-3 lists the hardware revision number for all supported SIPs.

Table 1-3 SIP Hardware and Software Compatibility

SIP	Part Number	Minimum Cisco IOS XR Software Release	Minimum Hardware Revision
Cisco XR 12000 SIP-600	12000-SIP-600	3.2	
Cisco XR 12000 SIP-401	12000-SIP-401	3.3	

Table 1-3 SIP Hardware and Software Compatibility

SIP	Part Number	Minimum Cisco IOS XR Software Release	Minimum Hardware Revision
Cisco XR 12000 SIP-501	12000-SIP-501	3.3	
Cisco XR 12000 SIP-601	12000-SIP-601	3.3	

The **show version** and **show hardware** commands display the current hardware configuration of the router, including the system software version that is currently loaded and running. For complete descriptions of **show** commands, refer to the *Cisco IOS XR Configuration Fundamentals Configuration Guide* and the *Cisco IOS XR Configuration Fundamentals Command Reference* for the installed Cisco Cisco IOS XR release.

Cisco XR 12000 SIP-600 Overview

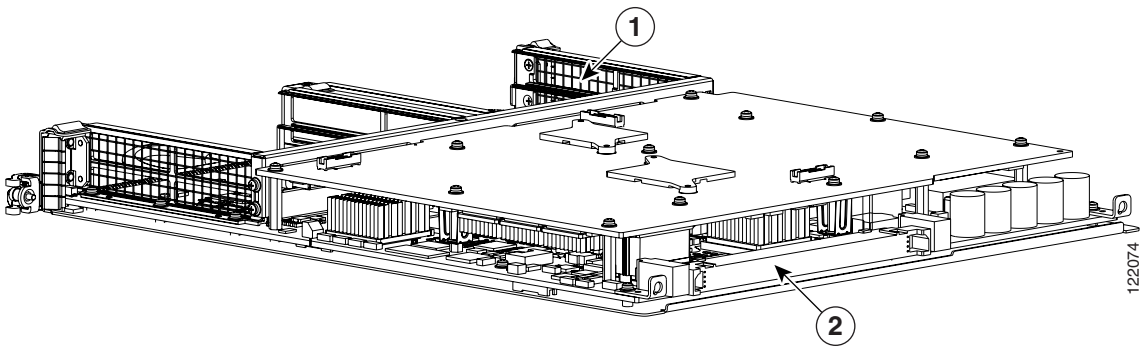
The following sections describe the Cisco XR 12000 SIP-600:

- Cisco XR 12000 SIP-600 Board Components, page 1-5
- Cisco XR 12000 SIP-600 LEDs, page 1-6
- Cisco XR 12000 SIP-600 Physical Specifications, page 1-6
- SPA Subslot Numbering on the Cisco XR 12000 SIP-600, page 1-6
- SPA Interface Addresses on the Cisco XR 12000 SIP-600, page 1-7

Cisco XR 12000 SIP-600 Board Components

The main Cisco XR 12000 SIP-600 board components are shown in Figure 1-1.

Figure 1-1 Cisco XR 12000 SIP-600 Board—Rear View

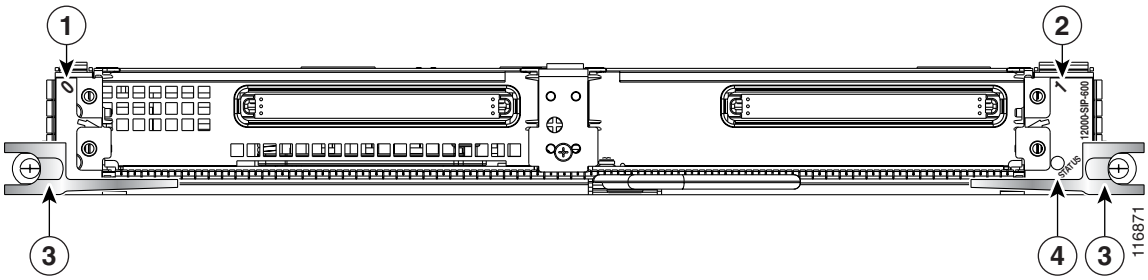


1	SPA enclosure	2	Backplane connector

Cisco XR 12000 SIP-600 LEDs

The Cisco XR 12000 SIP-600 supports 2 single-width, double-height SPAs, 2 single-width, single-height SPAs, or 1 dual-width, double-height SPA. The Cisco XR 12000 SIP-600 face plate has one Status LED. Figure 1-2 shows the Cisco 12000 SIP-600 face plate with 2 single-width, single-height SPAs.

Figure 1-2 Cisco XR 12000 SIP-600 Face Plate



1	SPA subslot 0	**3**	Ejector Levers
2	SPA subslot 1	**4**	Status LED

The Cisco XR 12000 SIP-600 LEDs are described in Table 1-4.

Table 1-4 Cisco XR 12000 SIP-600 LEDs

LED Label	Color	State	Meaning
Status	Yellow	On	SIP is powered and IOS is loading.
	Green	On	SIP is active.

Cisco XR 12000 SIP-600 Physical Specifications

The Cisco XR 12000 SIP-600 physical specifications are shown in the following table.

Table 1-5 Cisco XR 12000 SIP-600 Physical Specifications

Description	Specifications
Physical dimensions	Occupies one line card slot on a Cisco 12000 Series Router
Shipping weight	10kg
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	–4 to 149°F (–20 to 65°C)

SPA Subslot Numbering on the Cisco XR 12000 SIP-600

The Cisco XR 12000 SIP-600 accepts 2 single-width SPAs or 1 dual-width SPA.

Figure 1-3 shows a Cisco XR 12000 SIP-600 with 2 SPAs installed. The left SPA slot is subslot 0 and the right SPA slot is subslot 1. If one dual-width SPA is installed, it is recognized as being in subslot 0.

Figure 1-3 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

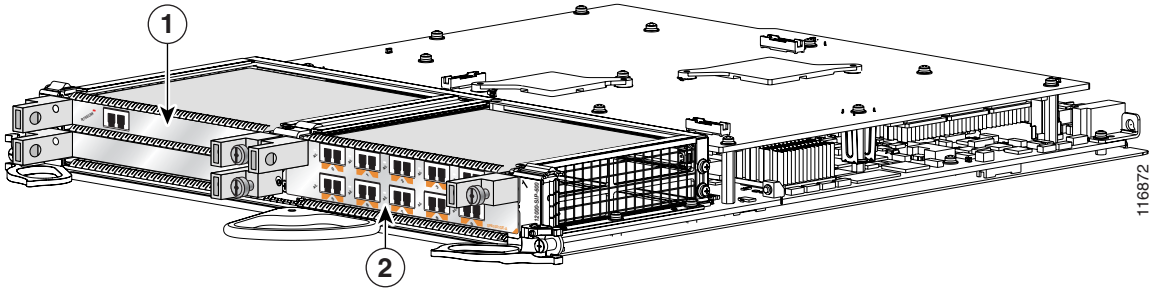


Table 1-6 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Subslot 0
2	Subslot 1

SPA Interface Addresses on the Cisco XR 12000 SIP-600

A Cisco 12000 Series Router identifies a SPA interface address by its SIP slot number, SPA subslot, and port number on the SPA, in the format *slot/subslot/port*. Subslots and ports are numbered starting from 0, so each Cisco XR 12000 SIP-600 has two subslots 0 (left) and 1 (right). For example, the interface address of a 1-port SPA located in the second SIP subslot, where the SIP is inserted into router line card slot 3 is 3/1/0. Figure 1-4 shows the slot, subslot, and port locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

Figure 1-4 Slot, Subslot, and Port Locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

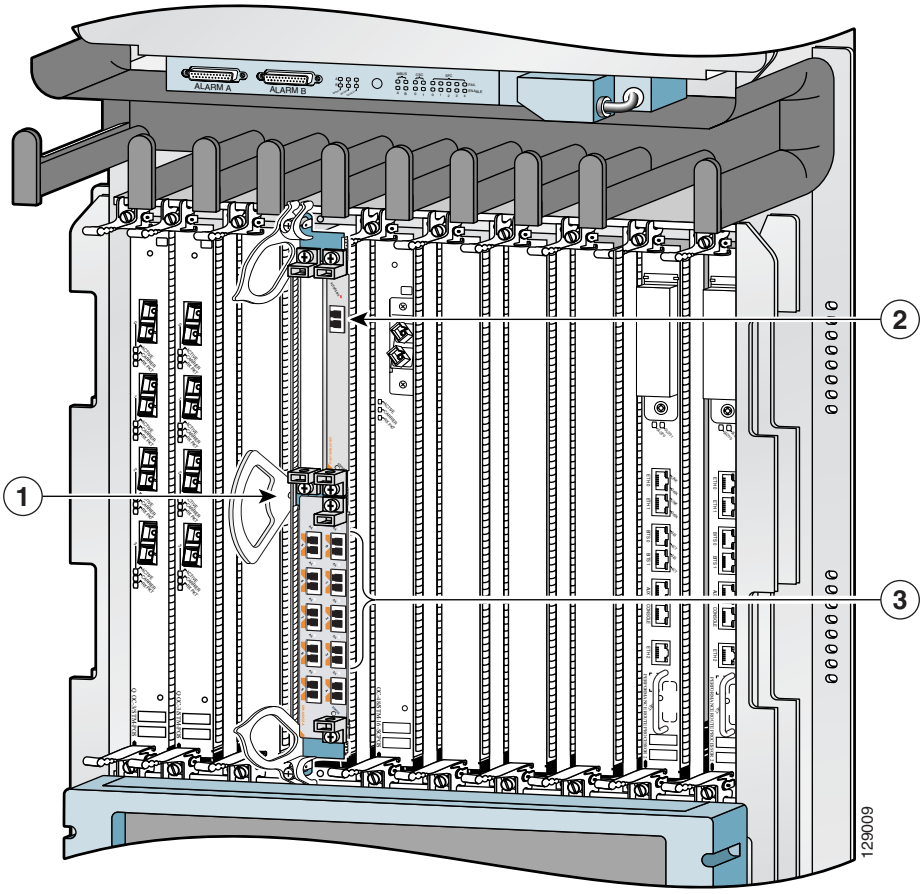


Table 1-7 Slot and Port Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Slot 3
2	Subslot 0, Port 3/0/0
3	Subslot 1, Ports 3/1/0 to 3/1/9

Cisco XR 12000 SIP-401 Overview

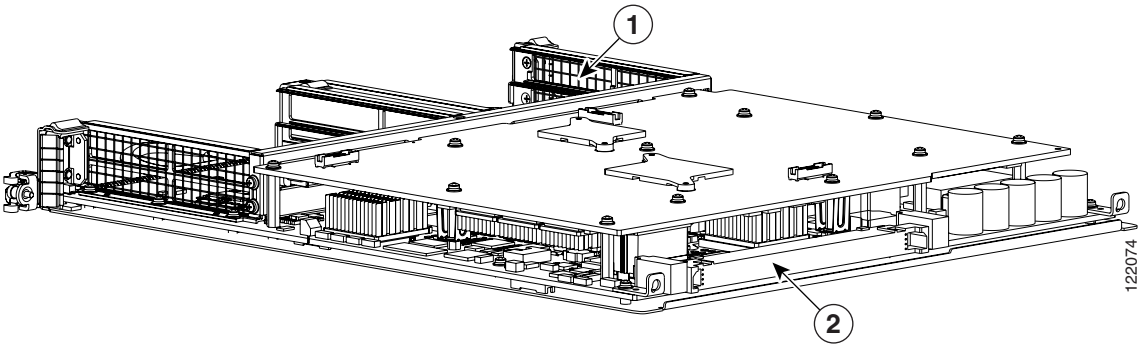
The following sections describe the Cisco XR 12000 SIP-401:

- Cisco XR 12000 SIP-401 Board Components, page 1-9
- Cisco XR 12000 SIP-401 LEDs, page 1-9
- Cisco XR 12000 SIP-401 Physical Specifications, page 1-10
- SPA Slot Numbering on the Cisco XR 12000 SIP-401, page 1-10
- SPA Interface Addresses on the Cisco XR 12000 SIP-401, page 1-11

Cisco XR 12000 SIP-401 Board Components

The main Cisco XR 12000 SIP-401 board components are shown in Figure 1-5.

Figure 1-5 Cisco XR 12000 SIP-401 Board—Rear View

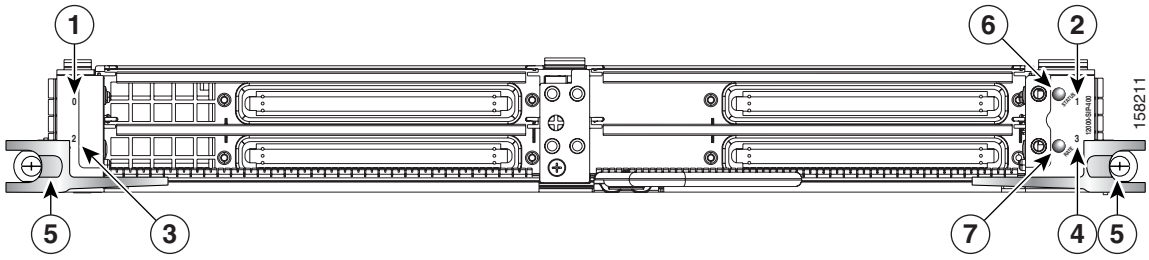


1	SPA enclosure	**2**	Backplane connector

Cisco XR 12000 SIP-401 LEDs

The Cisco XR 12000 SIP-401 has two LEDs, as shown in Figure 1-6.

Figure 1-6 Cisco XR 12000 SIP-401 Face Plate



1	SPA subslot 0	**5**	Ejector Levers
2	SPA subslot 1	**6**	Status LED
3	SPA subslot 2	**7**	Rate LED
4	SPA subslot 3		

The Cisco XR 12000 SIP-401 LEDs are described in Table 1-8.

Table 1-8 Cisco XR 12000 SIP-401 LED

LED Label	Color	State	Meaning
Status	Yellow	On	IOS is loaded and SIP is ready to be enabled.
	Green	On	SIP is active.

Table 1-8 Cisco XR 12000 SIP-401 LED

LED Label	Color	State	Meaning
Rate	Off	Off	SIP is SIP-401 or SIP-501.
	Green	On	SIP is SIP-601.

Cisco XR 12000 SIP-401 Physical Specifications

The Cisco XR 12000 SIP-401 physical specifications are shown in the following table.

Table 1-9 Cisco XR 12000 SIP-401 Physical Specifications

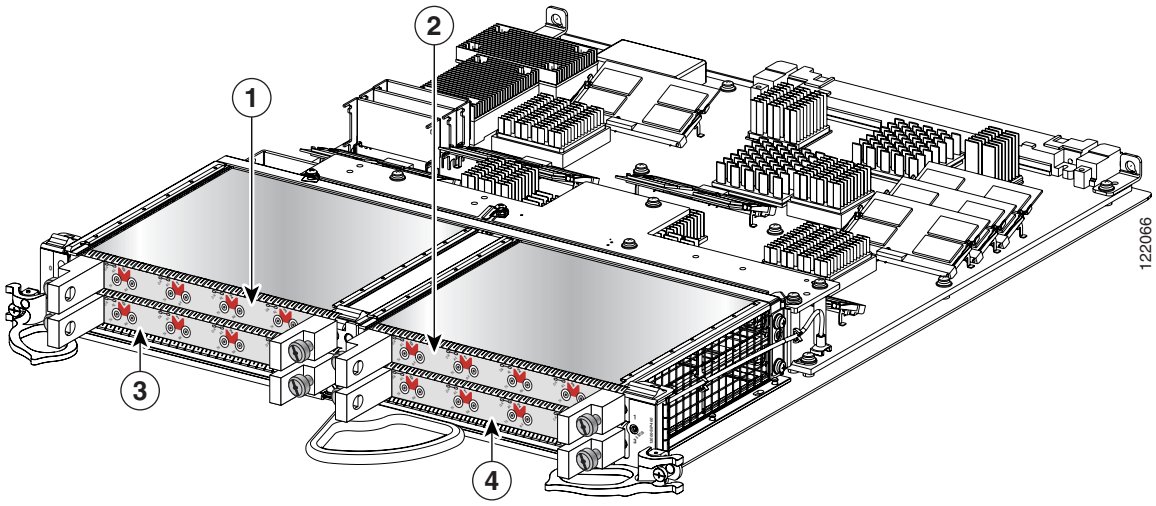
Description	Specifications
Physical dimensions	Occupies one line card slot on a Cisco 12000 Series Router
Shipping weight	10 kg
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	–4 to 149°F (–20 to 65°C)

SPA Slot Numbering on the Cisco XR 12000 SIP-401

The Cisco XR 12000 SIP-401 accepts 4 single-width, single-height SPAs.

Figure 1-7 shows a Cisco XR 12000 SIP-401 with 4 SPAs installed. The top leftmost SPA slot is subslot 0; the top rightmost SPA slot is subslot 1; the bottom leftmost SPA slot is subslot 2; the bottom rightmost SPA slot is subslot 3.

Figure 1-7 Cisco XR 12000 SIP-401 with SPAs Installed

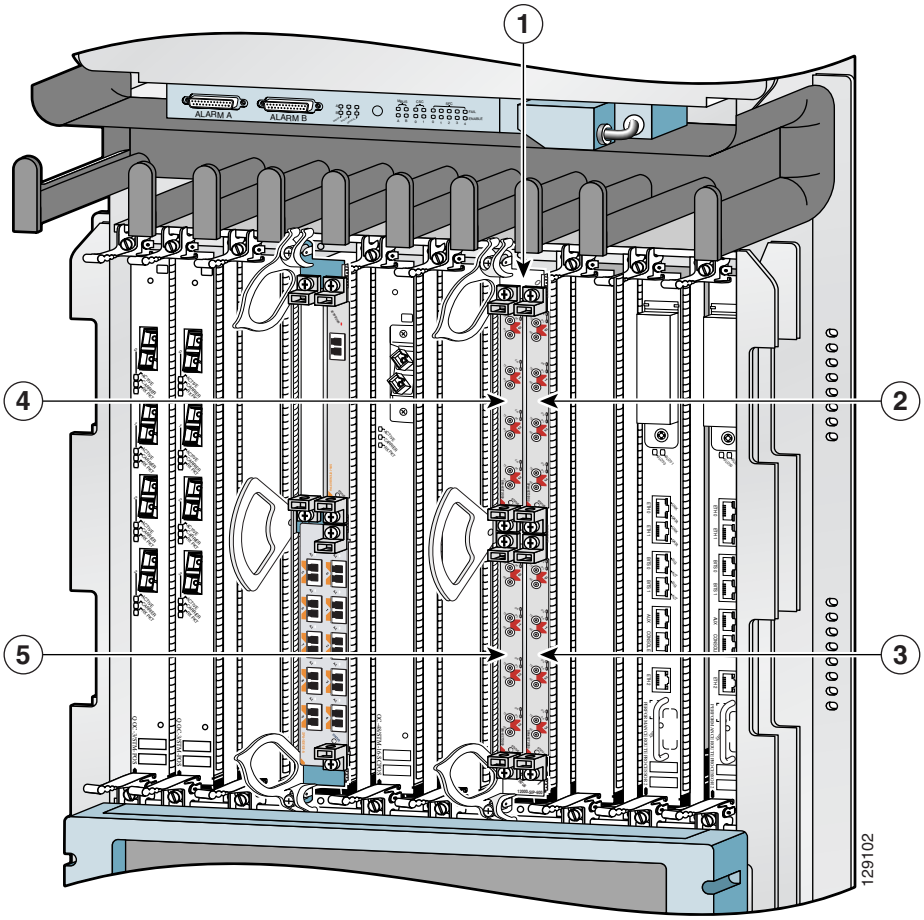


1	SPA subslot 0	**3**	SPA subslot 2
2	SPA subslot 1	**4**	SPA subslot 3

SPA Interface Addresses on the Cisco XR 12000 SIP-401

A Cisco 12000 Series Router identifies a SPA interface address by its SIP slot number, SPA subslot, and port number on the SPA, in the format *slot/subslot/port*. Subslots and ports are numbered starting from 0, so each Cisco XR 12000 SIP-401 has four subslots. A 4-port SPA would have ports 0 to 3. For example, the interface address of the second port on a 4-port SPA located in the first SIP subslot, where the SIP is inserted into router line card slot 6 is 6/0/1.

Figure 1-8 Cisco 12000 Series Router with Cisco XR 12000 SIP-401 Installed



1	Router slot number 6	**4**	SPA subslot 2 with ports 6/2/0 to 6/2/3
2	SPA subslot 0 with ports 6/0/0 to 6/0/3	**5**	SPA subslot 3 with ports 6/3/0 to 6/3/3
3	SPA subslot 1 with ports 6/1/0 to 6/1/3		

Cisco XR 12000 SIP-501 Overview

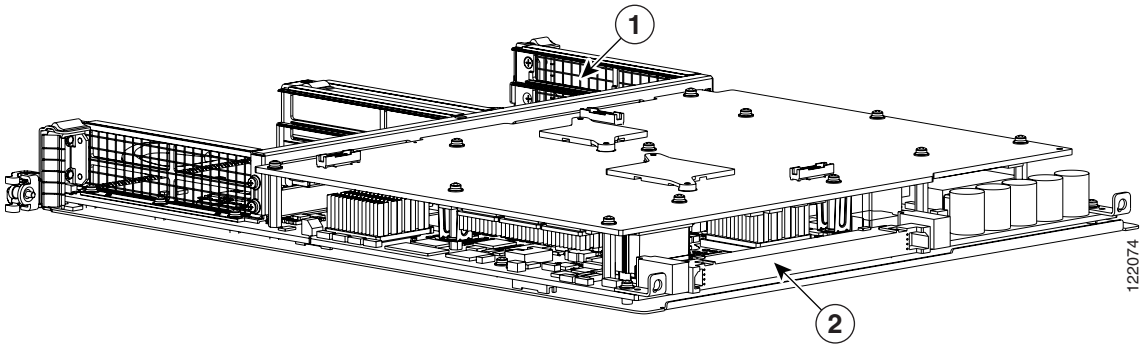
The following sections describe the Cisco XR 12000 SIP-501:

- Cisco XR 12000 SIP-501 Board Components, page 1-12
- Cisco XR 12000 SIP-501 LEDs, page 1-12
- Cisco XR 12000 SIP-501 Physical Specifications, page 1-13
- SPA Subslot Numbering on the Cisco XR 12000 SIP-501, page 1-13
- SPA Interface Addresses on the Cisco XR 12000 SIP-501, page 1-14

Cisco XR 12000 SIP-501 Board Components

The main Cisco XR 12000 SIP-501 board components are shown in Figure 1-9.

Figure 1-9 Cisco XR 12000 SIP-501 Board—Rear View

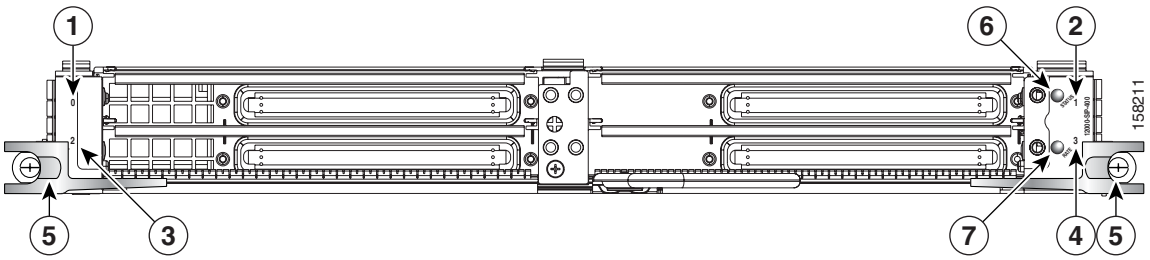


1	SPA enclosure	2	Backplane connector

Cisco XR 12000 SIP-501 LEDs

The Cisco XR 12000 SIP-501 supports 2 single-width, double-height SPAs, 2 single-width, single-height SPAs, or 1 dual-width, double-height SPA. The Cisco XR 12000 SIP-501 face plate has one Status LED. Figure 1-10 shows the Cisco XR 12000 SIP-501 face plate with 4 single-width, single-height SPAs.

Figure 1-10 Cisco XR 12000 SIP-501 Face Plate



1	SPA subslot 0	**4**	SPA subslot 3
2	SPA subslot 1	**5**	Ejector Levers
3	SPA subslot 2	**6**	Status LED

The Cisco XR 12000 SIP-501 LEDs are described in Table 1-10.

Table 1-10 Cisco XR 12000 SIP-501 LEDs

LED Label	Color	State	Meaning
Status	Yellow	On	IOS is loaded and SIP is ready to be enabled.
	Green	On	SIP is active.
Rate	Off	Off	SIP is SIP-401 or SIP-501.
	Green	On	SIP is SIP-601.

Cisco XR 12000 SIP-501 Physical Specifications

The Cisco XR 12000 SIP-501 physical specifications are shown in the following table.

Table 1-11 Cisco XR 12000 SIP-501 Physical Specifications

Description	Specifications
Physical dimensions	Occupies one line card slot on a Cisco 12000 Series Router
Shipping weight	10kg
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	–4 to 149°F (–20 to 65°C)

SPA Subslot Numbering on the Cisco XR 12000 SIP-501

The Cisco XR 12000 SIP-501 accepts up to 4 single-width SPAs or 1 dual-width SPA.

Figure 1-11 shows a Cisco XR 12000 SIP-501 with 2 SPAs installed. The left SPA slot is subslot 0 and the right SPA slot is subslot 1. If one dual-width SPA is installed, it is recognized as being in subslot 0.

Figure 1-11 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

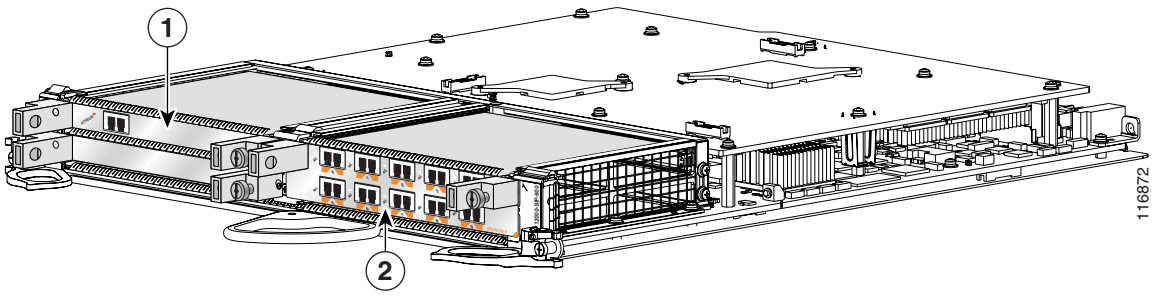


Table 1-12 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Subslot 0
2	Subslot 1

SPA Interface Addresses on the Cisco XR 12000 SIP-501

A Cisco 12000 Series Router identifies a SPA interface address by its SIP slot number, SPA subslot, and port number on the SPA, in the format *slot/subslot/port*. Subslots and ports are numbered starting from 0, so each Cisco XR 12000 SIP-601 has two subslots 0 (left) and 1 (right). For example, the interface address of a 1-port SPA located in the second SIP subslot, where the SIP is inserted into router line card slot 3 is 3/1/0. Figure 1-12 shows the slot, subslot, and port locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

Figure 1-12 Slot, Subslot, and Port Locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

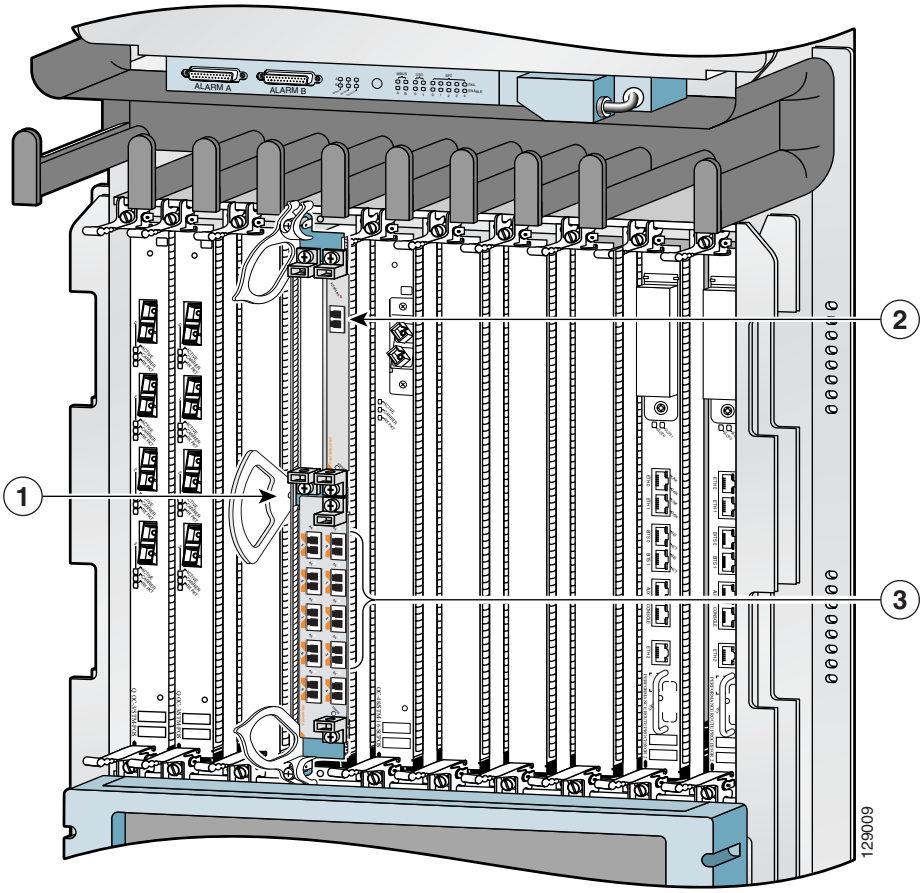


Table 1-13 Slot and Port Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Slot 3
2	Subslot 0, Port 3/0/0
3	Subslot 1, Ports 3/1/0 to 3/1/9

Cisco XR 12000 SIP-601 Overview

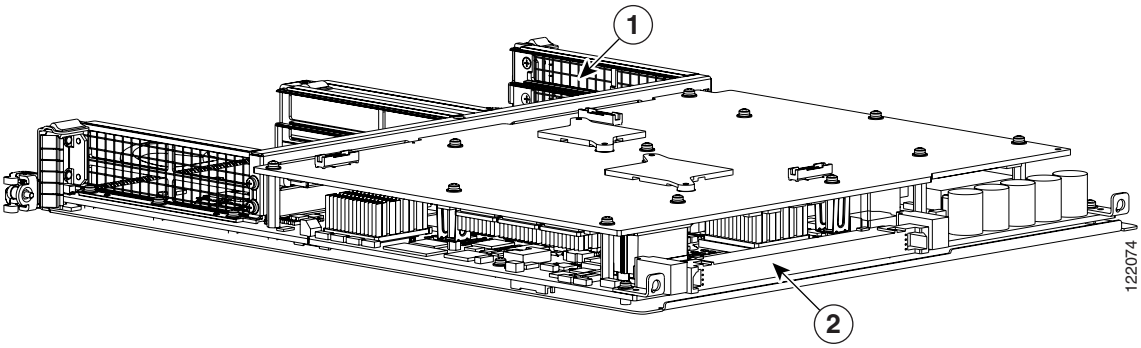
The following sections describe the Cisco XR 12000 SIP-601:

- Cisco XR 12000 SIP-601 Board Components, page 1-15
- Cisco XR 12000 SIP-601 LEDs, page 1-15
- Cisco XR 12000 SIP-601 Physical Specifications, page 1-16
- SPA Subslot Numbering on the Cisco XR 12000 SIP-601, page 1-16
- SPA Interface Addresses on the Cisco XR 12000 SIP-601, page 1-17

Cisco XR 12000 SIP-601 Board Components

The main Cisco XR 12000 SIP-601 board components are shown in Figure 1-13.

Figure 1-13 Cisco XR 12000 SIP-601 Board—Rear View

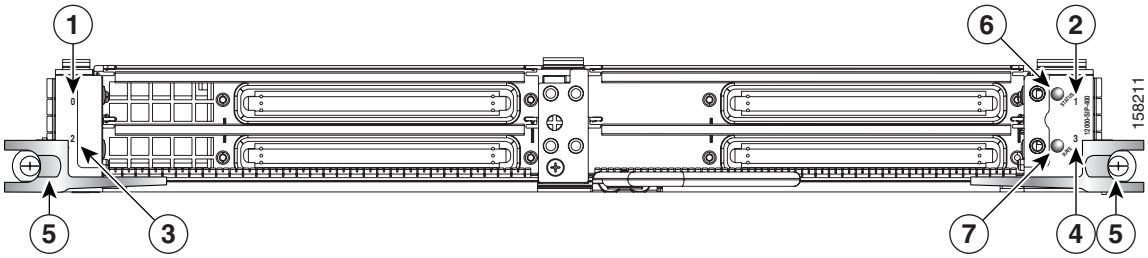


1	SPA enclosure	2	Backplane connector

Cisco XR 12000 SIP-601 LEDs

The Cisco XR 12000 SIP-601 supports 4 single-height SPAs (the aggregate throughput should not exceed 2 full-rate SPAs); 2 double-height SPAs; 1 dual-width, double-height SPA, or a combination of single-height and double-height SPAs. The Cisco XR 12000 SIP-601 face plate has one Status LED. Figure 1-14 shows the Cisco XR 12000 SIP-601 face plate with 4 single-width, single-height SPAs.

Figure 1-14 Cisco XR 12000 SIP-601 Face Plate



1	SPA subslot 0	**5**	Ejector Levers
2	SPA subslot 1	**6**	Status LED
3	SPA subslot 2	**7**	Rate LED
4	SPA subslot 3		

The Cisco XR 12000 SIP-601 LEDs are described in Table 1-14.

Table 1-14 Cisco XR 12000 SIP-601 LEDs

LED Label	Color	State	Meaning
Status	Yellow	On	IOS is loaded and SIP is ready to be enabled.
	Green	On	SIP is active.
Rate	Off	Off	SIP is SIP-401 or SIP-501.
	Green	On	SIP is SIP-601.

Cisco XR 12000 SIP-601 Physical Specifications

The Cisco XR 12000 SIP-601 physical specifications are shown in the following table.

Table 1-15 Cisco XR 12000 SIP-601 Physical Specifications

Description	Specifications
Physical dimensions	Occupies one line card slot on a Cisco 12000 Series Router
Shipping weight	10kg
Operating temperature	32 to 104°F (0 to 40°C)
Relative humidity	10 to 90 percent, noncondensing
Storage temperature	–4 to 149°F (–20 to 65°C)

SPA Subslot Numbering on the Cisco XR 12000 SIP-601

The Cisco XR 12000 SIP-601 accepts 4 single-height SPAs (the aggregate throughput should not exceed 2 full-rate SPAs); 2 double-height SPAs; 1 dual-width, double-height SPA, or a combination of single-height and double-height SPAs.

Figure 1-15 shows a Cisco XR 12000 SIP-601 with 2 SPAs installed. The left SPA slot is subslot 0 and the right SPA slot is subslot 1. If one dual-width SPA is installed, it is recognized as being in subslot 0.

Figure 1-15 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

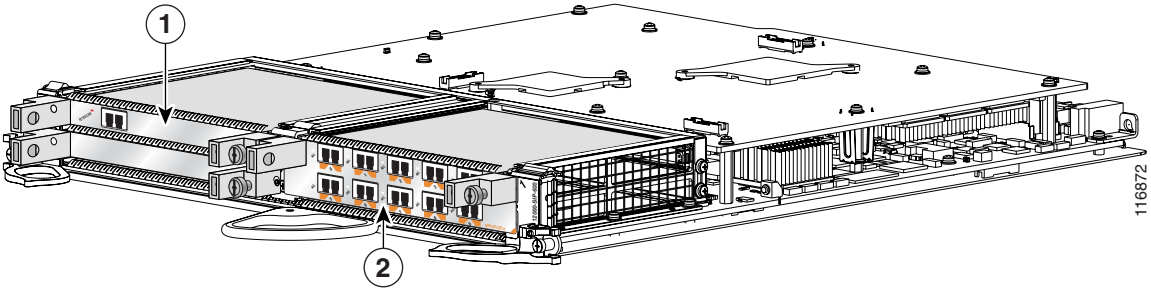


Table 1-16 Subslot Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Subslot 0
2	Subslot 1

SPA Interface Addresses on the Cisco XR 12000 SIP-601

A Cisco 12000 Series Router identifies a SPA interface address by its SIP slot number, SPA subslot, and port number on the SPA, in the format *slot/subslot/port*. Subslots and ports are numbered starting from 0, so each Cisco XR 12000 SIP-601 has two subslots 0 (left) and 1 (right). For example, the interface address of a 1-port SPA located in the second SIP subslot, where the SIP is inserted into router line card slot 3 is 3/1/0. Figure 1-16 shows the slot, subslot, and port locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

Figure 1-16 Slot, Subslot, and Port Locations for the 1-Port 10-Gigabit Ethernet SPA and the 10-Port Gigabit Ethernet SPA.

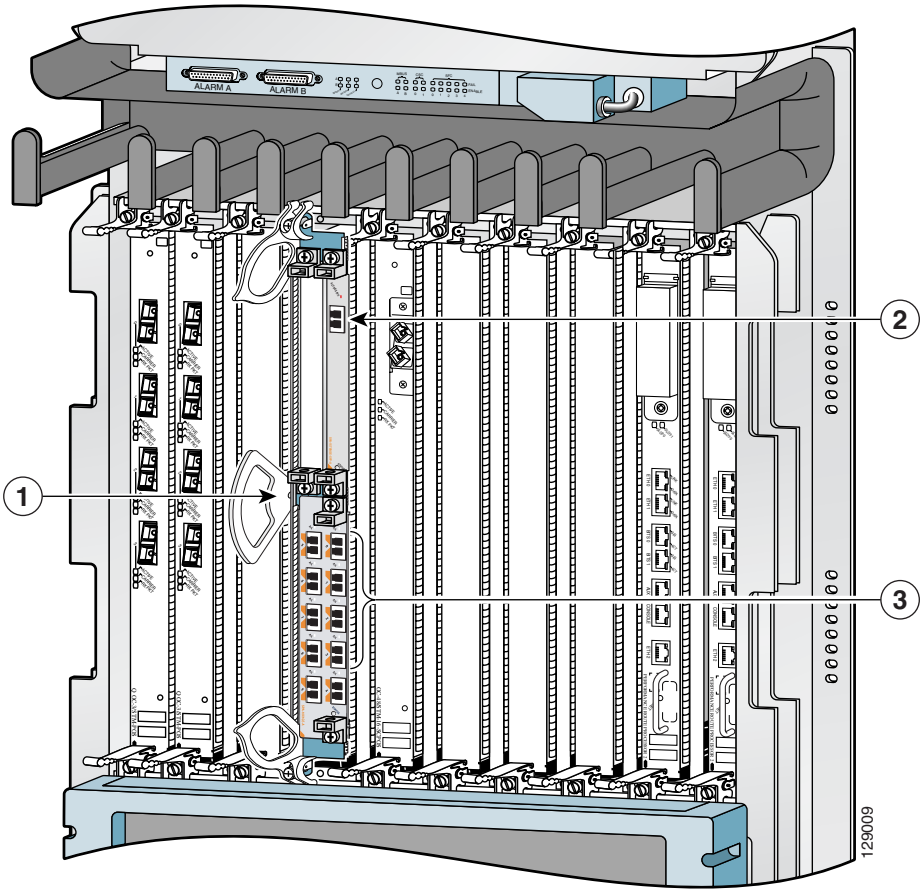


Table 1-17 Slot and Port Locations for the 1-Port 10-Gigabit Ethernet SPA

Call Out Number	Description
1	Slot 3
2	Subslot 0, Port 3/0/0
3	Subslot 1, Ports 3/1/0 to 3/1/9

CHAPTER 2

Overview: Cisco XR 12000 Series Router Shared Port Adaptors

Revised: June 2008, OL-9175-05

This chapter describes the shared port adaptors (SPAs) that are supported on the Cisco XR 12000 series router and contains the following sections:

- SPA Summary, page 2-2
- Bandwidth Oversubscription, page 2-3
- 2-Port and 4-Port T3/E3 Serial SPA Overview, page 2-4
- 2-Port and 4-Port Channelized T3 to DS0 SPA Overview, page 2-6
- 8-Port Channelized T1/E1 SPA Overview, page 2-8
- 8 Port FastEthernet SPA Overview, page 2-10
- 1 Port 10-Gigabit Ethernet SPA Overview, page 2-13
- 2-Port Gigabit Ethernet SPA Overview, page 2-15
- 5-Port Gigabit Ethernet SPA Overview, page 2-21
- 10-Port Gigabit Ethernet SPA Overview, page 2-25
- 1-Port Channelized STM-1/OC-3 SPA Overview, page 2-29
- 1-Port Channelized STM-4/OC-12 SPA Overview, page 2-32
- 1-Port Channelized STM-16/OC-48 SPA Overview, page 2-34
- 1-Port OC-192/STM-64 POS SPA Overview, page 2-37
- 1-Port OC-192 STM-64 POS RPR XFP SPA Overview, page 2-40
- 4-Port OC-3/STM-1 POS SPA Overview, page 2-44
- 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Overview, page 2-49
- 1-Port OC-12/STM-4 POS SPA Overview, page 2-54
- 1-Port OC-48/STM-16 POS SPA Overview, page 2-57
- 2-Port and 4-Port OC-48/STM-16 POS SPA Overview, page 2-60
- 2-Port OC-48 POS RPR SPA Overview, page 2-64
- Cisco XR 12000 IPSec VPN SPA Overview, page 2-66
- 1-Port and 3-Port Clear Channel OC-3 ATM SPA Overview, page 2-68
- 1-Port Clear Channel OC-12 ATM SPA Overview, page 2-70

- 2-Port Channelized T3/E3 ATM CEoP SPA Overview, page 2-73

SPA Summary

Table 2-1 shows the summary descriptions of the SPAs that are supported on the Cisco XR 12000 series router.

Table 2-1 Supported SPAs on Cisco XR 12000 Series Routers

Product Number	Description	Number of Ports	Minimum IOS XR Release	Minimum Hardware Revision
SPA-2XT3/E3	2-Port T3/E3 Serial SPA	2	3.3	1.0
SPA-4XT3/E3	4-Port T3/E3 Serial SPA	4	3.3	1.0
SPA-2XCT3/DS0	2-Port Channelized T3 to DS0 SPA	2	3.3	1.0
SPA-4XCT3/DS0	4-Port Channelized T3 to DS0 SPA	4	3.3	1.0
SPA-8XCHT1/E1	8-Port Channelized T1/E1 SPA	8	3.6	1.0
SPA-8XFE	8-Port FastEthernet SPA	8	3.3	1.0
SPA-8X1FE-TX-V2	8-Port Fast Ethernet SPA	8	3.4	1.0
SPA-1XTENGE-XFP	1-Port 10-Gigabit Ethernet SPA	1	3.2	1.0
SPA-1X10GE-L-V2	1-Port 10-Gigabit Ethernet SPA	1	3.4	1.0
SPA-2X1GE-V2	2-Port Gigabit Ethernet SPA	2	3.4.1	1.0
SPA-5XGE	5-Port Gigabit Ethernet SPA	5	3.2	1.0
SPA-5XGE-V2	5-Port Gigabit Ethernet SPA	5	3.4	1.0
SPA-10XGE	10-Port Gigabit Ethernet SPA	10	3.2	1.0
SPA-10X1GE-V2	10-Port Gigabit Ethernet SPA	10	3.4	1.0
SPA-1XCHOC3/DS0	1-Port Channelized STM-1/OC-3 SPA	1	3.5	1.0
SPA-1XCHOC12/DS0	1-Port Channelized STM-4/OC-12 SPA	1	3.5	1.0
SPA-1XCHOC48/DS3	1-Port Channelized STM-16/OC-48 SPA	1	3.6	1.0
SPA-OC192POS	1-Port OC-192/STM-64 POS SPA	1	3.2	1.0
SPA-4XOC3POS	4-Port OC-3/STM-1 POS SPA	4	3.5	1.0
SPA-8XOC12-POS	8-Port OC-3 STM-1/OC-12 STM-4 POS SPA	8	3.5	1.0
SPA-OC48POS	1-Port OC-48/STM-16 POS SPA	1	3.6	1.0
SPA-4XOC48POS	4-Port OC-48/STM-16 POS/RPR SPA	4	3.5	1.0
SPA-2XOC48POS	2-Port OC48-POS/RPR SPA	2	3.3	1.0
SPA-IPSEC-2G-2	IPSec VPN SPA	-	3.4	1.0
SPA-1XOC3-ATM-V2	1-Port Clear Channel OC-3 ATM SPA	1	3.7	1.0
SPA-3XOC3-ATM-V2	3-Port Clear Channel OC-3 ATM SPA	3	3.7	1.0
SPA-1XOC12-ATM-V2	1-Port Clear Channel OC-12 ATM SPA	1	3.7	1.0
SPA-2CHT3-CE-ATM	2-Port Channelized T3/E3 ATM CEoP SPA	2	3.7	1.0

Checking Hardware and Software Compatibility

To check the minimum software requirements of Cisco IOS XR software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com. This tool does not verify whether SIPs or SPAs within a system are compatible, but it does provide the minimum Cisco IOS XR requirements for individual hardware modules or components.

Note Access to this tool is limited to users with Cisco.com login accounts.

To access Software Advisor, click **Login** at Cisco.com, type "Software Advisor" in the SEARCH box, and click **GO**. Click the link for the Software Advisor tool.

Choose a product family or enter a specific product number to search for the minimum supported software release needed for your hardware.

Bandwidth Oversubscription

Oversubscribing the bandwidth limit recommendations of a router can result in decreased or degraded performance. For this reason, it is important to determine the amount of bandwidth used by the SPAs on the router and verify that the total bandwidth used by all SPAs does not exceed the recommended bandwidth limit of the router.

Note The SIP-600 [10G SIP], SIP-401 [2.5G SIP], SIP-501 [5G SIP], and SIP-601 [10G SIP] can support up to 20G of installed SPAs, but the bandwidth through the engine and the fabric is no more than 10G (SIP-600 or SIP-601). The bandwidth through the engine and the fabric is no more than 5G for the SIP-501 and is no more than 2.5G for the SIP-401.

Table 2-2 provides information about the bandwidth for each port (per-port bandwidth) on a SPA, as well as the cumulative bandwidth (total bandwidth) for all ports available on the SPA.

Table 2-2 SPA Bandwidth Capacity

SPA	Per-Port Bandwidth	Number of Ports	Total Bandwidth
2-Port Channelized T3 SPA	44.736 Mbps	2	89.47 Mbps
4-Port Channelized T3 SPA	44.736 Mbps	4	178.94 Mbps
2-Port Clear Channel T3/E3 SPA	44.736 Mbps (T3) 34.368 Mbps (E3)	2	89.47 Mbps (T3) 68.74 Mbps (E3)
4-Port Clear Channel T3/E3 SPA	44.736 Mbps (T3) 34.368 Mbps (E3)	4	178.94 Mbps (T3) 137.47 Mbps (E3)
8-Port Channelized T1/E1 SPA	1.544 Mbps (T1) 2.048 Mbps (E1)	8	12.35 Mbps (T1) 16.38 Mbps (E1)
1-Port 10-Gigabit Ethernet SPA	10 Gbps	1	10 Gbps
5-Port Gigabit Ethernet SPA	1 Gbps	5	5 Gbps
10-Port Gigabit Ethernet SPA	1 Gbps	10	10 Gbps

Table 2-2 SPA Bandwidth Capacity (continued)

SPA	Per-Port Bandwidth	Number of Ports	Total Bandwidth
1-Port Channelized STM-1/OC-3 SPA	155.52 Mbps	1	155.52 Mbps
1-Port Channelized STM-4/OC-12 SPA	622.08 Mbps	1	622.08 Mbps
1-Port Channelized STM-16/OC-48 SPA	2.488 Gbps	1	2.488 Gbps
1-Port OC-192/STM-64 POS SPA	9.953 Gbps	1	9.953 Gbps
4-Port OC-3/STM-1 POS SPA	155.52 Mbps	4	622.08 Mbps
8-Port OC-3 STM-1/OC-12 STM-4 POS SPA	155.52 Mbps or 622.08 Mbps	8	5 Gbps[1]
1-Port OC-12/STM-4 POS SPA	622.08 Mbps	1	622.08 Mbps
1-Port OC-48/STM-16 POS SPA	2.488 Gbps	1	2.488 Gbps
4-Port OC-48/STM-16 POS/RPR SPA	2.488 Gbps	4	10 Gbps
2-Port OC48-POS/RPR SPA	2.488 Gbps	2	4.976 Gbps
1-Port Clear Channel OC-3 ATM SPA	155.52 Mbps	1	155.52 Mbps
3-Port Clear Channel OC-3 ATM SPA	155.52 Mbps	3	466.56 Mbps
1-Port Clear Channel OC-12 ATM SPA	622.08 Mbps	1	622.08 Mbps

1. Total bandwidth value assumes eight OC-12/STM-4 optics modules.

2-Port and 4-Port T3/E3 Serial SPA Overview

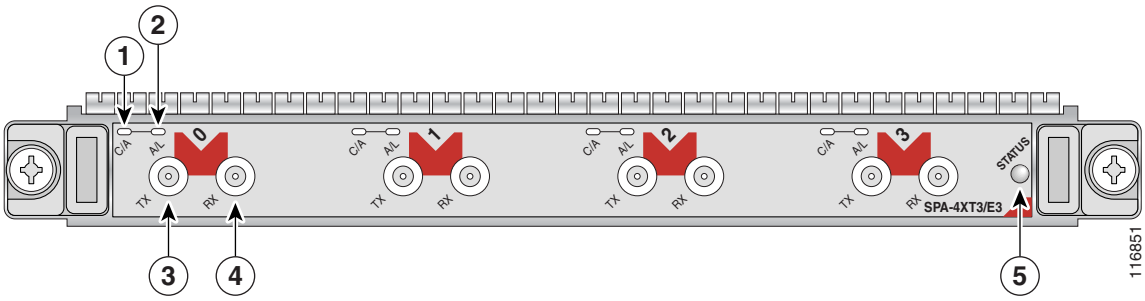
The following sections describe the 2-Port and 4-Port Clear Channel T3/E3 SPA:

- 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs, page 2-4
- 2-Port and 4-Port Clear Channel T3/E3 SPA Interface Specifications, page 2-5
- 2-Port and 4-Port Clear Channel T3/E3 SPA Cables and Connectors, page 2-6

2-Port and 4-Port Clear Channel T3/E3 SPA LEDs

The 2-Port and 4-Port Clear Channel T3/E3 SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 2-1 shows an example of these LEDs on a 4-Port Clear Channel T3/E3 SPA.

Figure 2-1 4-Port Clear Channel T3/E3 SPA Faceplate



1	C/A (Carrier/Alarm) LED	**4**	RX (Receive) connector
2	A/L (Active Loopback) LED	**5**	STATUS LED
3	TX (Transmit) connector		

The 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs are described in Table 2-3.

Table 2-3 2-Port and 4-Port Clear Channel T3/E3 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid E3 or T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

2-Port and 4-Port Clear Channel T3/E3 SPA Interface Specifications

The framer processes incoming and outgoing T3 (cbit, m13/m23, and unframe) and E3 (g751, g832, and unframe) frames. The framer operates at T3/E3 line rates (44.2/34.0 Mbps) depending on the mode in which it is configured.

Packet data is transported with a user-configurable encapsulation (such as Point-to-Point Protocol [PPP] or High-Level Data Link Control [HDLC]), and is mapped to T3 and E3 frames. The encapsulations add transport overhead to the packet of data frames before transporting, and are stripped when a packet is transported to the far end.

The T3/E3 SPA interface is compliant with ANSI and Telco standards. The interface also provides support for Management Information Base (MIB) RFC 2496 and T1.231.

2-Port and 4-Port Clear Channel T3/E3 SPA Cables and Connectors

The interface connectors on the 2-Port and 4-Port Clear Channel T3/E3 SPA are 75-ohm coaxial Siemax types, with one connector and cable for transmit (TX) and one for receive (RX).

The following cables can be used with the 2-Port and 4-Port Clear Channel T3/E3 SPA. The cables have BNC connectors on one end and the Siemax connectors on the other.

- CAB-T3E3-RF-BNC-M (T3 or E3 Cable, 1.0/2.3 RF to BNC-Male, 10 feet)
- CAB-T3E3-RF-BNC-F (T3 or E3 Cable, 1.0/2.3 RF to BNC-Female, 10 feet)
- CAB-T3E3-RF-OPEN (T3 or E3 Cable, 1.0/2.3 RF to BNC-Open end, 10 feet)

Note The Cisco cable part numbers are 72-4124-01 (with male BNC end) and 72-4131-01 (with female BNC end).

Figure 2-1 shows the connectors on the 4-Port Clear Channel T3/E3 SPA, and Table 2-4 describes the signal descriptions for these connectors.

Table 2-4 2-Port and 4-Port Clear Channel T3/E3 SPA Connectors

Connector Label	Meaning
TX	Transmitted signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the TX BNC connector.
RX	Received signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the RX BNC connector.

2-Port and 4-Port Channelized T3 to DS0 SPA Overview

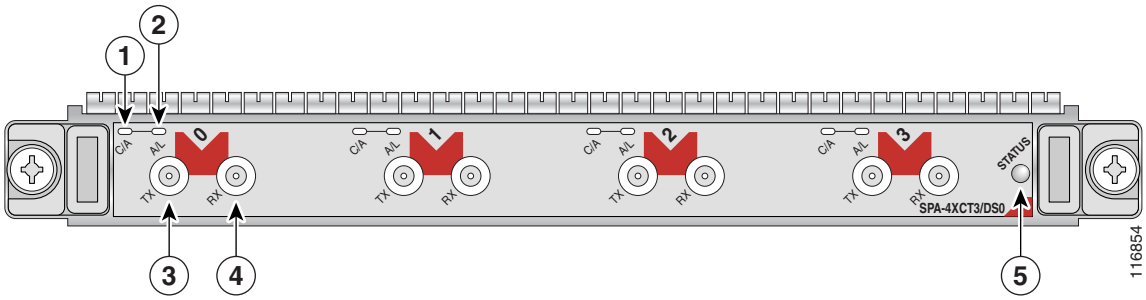
The following sections describe the 2-Port and 4-Port Channelized T3 SPA:

- 2-Port and 4-Port Channelized T3 SPA LEDs, page 2-7
- 2-Port and 4-Port Channelized T3 SPA Interface Specifications, page 2-7
- 2-Port and 4-Port Channelized T3 SPA Cables and Connectors, page 2-8

2-Port and 4-Port Channelized T3 SPA LEDs

The 2-Port and 4-Port Channelized T3 SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 2-2 shows an example of these LEDs on a 4-Port Channelized T3 SPA.

Figure 2-2 4-Port Channelized T3 SPA Faceplate



1	C/A (Carrier/Alarm) LED	**4**	RX (Receive) connector
2	A/L (Active Loopback) LED	**5**	STATUS LED
3	TX (Transmit) connector		

The 2-Port and 4-Port Channelized T3 SPA LEDs are described in Table 2-5.

Table 2-5 2-Port and 4-Port Channelized T3 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

2-Port and 4-Port Channelized T3 SPA Interface Specifications

The framer processes incoming and outgoing T3 frames (cbit, m13/m23, and unframe). The framer operates at T3 line rates (44.2 Mbps).

Packet data is transported with a user-configurable encapsulation (such as Point-to-Point Protocol [PPP] or High-Level Data Link Control [HDLC]), and is mapped to T3 frames. The encapsulations add transport overhead to the packet of data frames before transporting, and are stripped when a packet is transported to the far end.

The T3 SPA interface is compliant with ANSI and Telco standards. The interface also provides support for Management Information Base (MIB) RFC 2495, RFC 2496, and T1.231.

2-Port and 4-Port Channelized T3 SPA Cables and Connectors

The interface connectors on the 2-Port and 4-Port Channelized T3 SPA are 75-ohm coaxial Siemax types, with one connector and cable for transmit (TX) and one for receive (RX).

The following cables can be used with the 2-Port and 4-Port Channelized T3 SPA. The cables have BNC connectors on one end and the Siemax connectors on the other.

- CAB-T3E3-RF-BNC-M (T3 or E3 Cable, 1.0/2.3 RF to BNC-Male, 10 feet)
- CAB-T3E3-RF-BNC-F (T3 or E3 Cable, 1.0/2.3 RF to BNC-Female, 10 feet)
- CAB-T3E3-RF-OPEN (T3 or E3 Cable, 1.0/2.3 RF to BNC-Open end, 10 feet)

Note The Cisco cable part numbers are 72-4124-01 (with Male BNC end) and 72-4131-01 (with Female BNC end).

Figure 2-2 shows the Siemax connectors on the 2-Port and 4-Port Channelized T3 SPA, and Table 2-6 provides the signal descriptions for these connectors.

Table 2-6 2-Port and 4-Port Channelized T3 SPA Connectors

Connector Label	Meaning
TX	Transmitted signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the TX Siemax connector.
RX	Received signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the RX Siemax connector.

8-Port Channelized T1/E1 SPA Overview

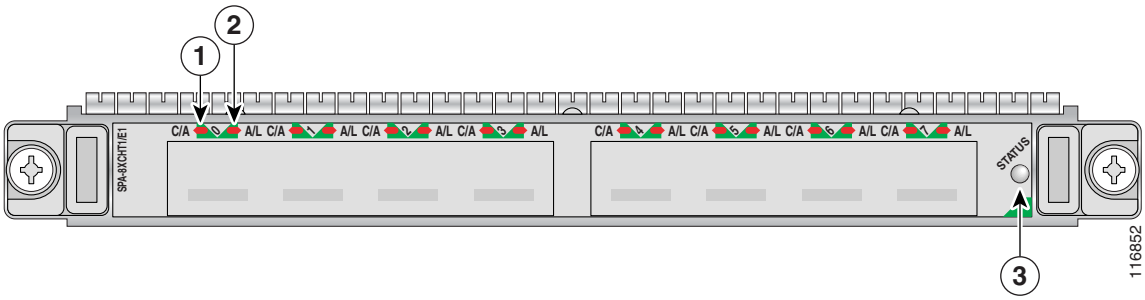
The following sections describe the 8-Port Channelized T1/E1 SPA:

- 8-Port Channelized T1/E1 SPA LEDs, page 2-9
- XFP Connections, page 2-14
- 8-Port Channelized T1/E1 SPA Cables, Connectors, and Pinouts, page 2-10

8-Port Channelized T1/E1 SPA LEDs

The 8-Port Channelized T1/E1 SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED as shown in Figure 2-3.

Figure 2-3 8-Port Channelized T1/E1 SPA Faceplate



1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

The 8-Port Channelized T1/E1 SPA LEDs are described in Table 2-7.

Table 2-7 8-Port Channelized T1/E1 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid T1 or E1 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

8-Port Channelized T1/E1 SPA Interface Specifications

The E1 interface on the 8-Port Channelized T1/E1 SPA uses RJ-48c receptacles for E1 (120-Ohm) cables with RJ-45 connectors. You can use all ports simultaneously. Each E1 connection supports interfaces that meet G.703 standards. The RJ-45 connection does not require an external transceiver. The E1 ports are E1 interfaces that use 120-ohm shielded twisted pair (STP) cables.

Warning **Shielded twisted pair (STP) T1/E1 cables must be used to comply with EN55022/CISPR22 Class A emissions requirements. For revisions 73-8358-05 through 73-8358-08 Shielded Twisted pair (STP) T1/E1 cables must be used to comply with FCC Class A emissions requirements.**

8-Port Channelized T1/E1 SPA Cables, Connectors, and Pinouts

Figure 2-4 shows an RJ-45 connector.

Note The terms RJ-45 and RJ-48c are sometimes used interchangeably. The RJ-48c is the jack or receptacle; the RJ-45 is the connector.

Figure 2-4 RJ-45 Connector

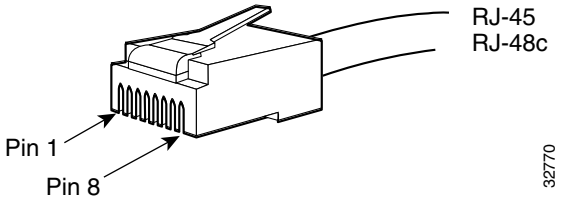


Table 2-8 describes the signals and connector pinouts for RJ-45 cable connectors.

Table 2-8 RJ-45 Connector Pinouts

Pin	Signal	Description
1	RX–	Receive ring –
2	RX+	Receive tip +
3	NC	No connection
4	TX–	Transmit ring –
5	TX+	Transmit tip +
6	NC	No connection
7	NC	No connection
8	NC	No connection

8 Port FastEthernet SPA Overview

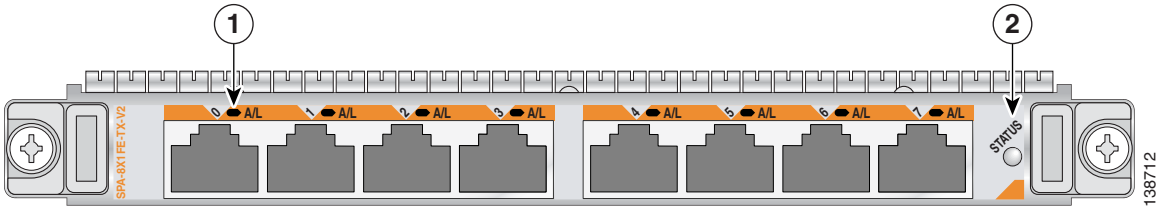
The following sections describe the 8-Port FastEthernet SPA:

- 8-Port FastEthernet SPA LEDs, page 2-11
- 8-Port FastEthernet SPA Cables, Connectors, and Pinouts, page 2-11

8-Port FastEthernet SPA LEDs

The 8-Port FastEthernet SPA has two types of LEDs: an A/L LED for each individual port and a STATUS LED for the SPA, as shown in Figure 2-5.

Figure 2-5 8-Port FastEthernet SPA Faceplate



1	A/L (Active/Link) LED	2	STATUS LED

Table 2-9 describes the 8-Port FastEthernet SPA LEDs.

Table 2-9 8-Port FastEthernet SPA LEDs

LED Label	Color	State	Meaning
Port Number A/L (0, 1, 2, 3, 4, 5, 6 or 7)[1]	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

1. In this case, port number refers to the numbered LEDs on the 8-Port FastEthernet SPA (0, 1, 2, 3, 4, 5, 6 or 7). Each LED number on the 8-Port FastEthernet SPA references a port on the SPA.

8-Port FastEthernet SPA Cables, Connectors, and Pinouts

The interface connectors on the 8-Port FastEthernet SPA are eight individual RJ-45 receptacles. You can use all eight interface connectors simultaneously. Each connection supports IEEE 802.3 and Ethernet 10/100BASE-T interfaces compliant with appropriate standards. Cisco Systems does not supply Category 5 unshielded twisted-pair (UTP) RJ-45 cables; these cables are available commercially.

Figure 2-6 shows the RJ-45 connector.

Figure 2-6 RJ-45 Connections, Plug, and Receptacle

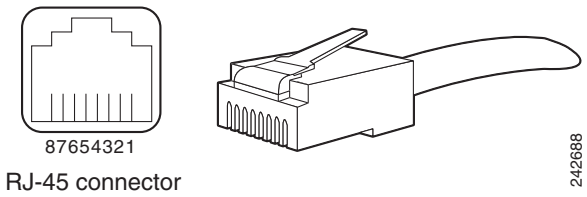


Table 2-10 lists the pinouts and signals for the RJ-45 connector.

Table 2-10 RJ-45 Connector Pinout

Pin	Description
1	Transmit data + (TxD+)
2	TxD–
3	Receive data + (RxD+)
4	Reserved
5	Reserved
6	RxD–
7	Reserved
8	Reserved

Note Referring to the RJ-45 pinout in Table 2-10, proper common-mode line terminations should be used for the unused Category 5 UTP cable pairs 4/5 and 7/8. Common-mode termination reduces the contributions to electromagnetic interference (EMI) and susceptibility to common-mode sources. Wire pairs 4/5 and 7/8 are actively terminated in the RJ-45 port circuitry in the 8-Port FastEthernet SPA.

The 8-Port FastEthernet SPA supports automatic MDI/MDIX crossover at all speeds of operation allowing the SPA to work with straight-through and crossover Ethernet cables. Depending on your RJ-45 interface cabling requirements, use the pinouts in Figure 2-7 and Figure 2-8.

Figure 2-7 Straight-Through Cable Pinout, RJ-45 Connection to a Hub or Repeater

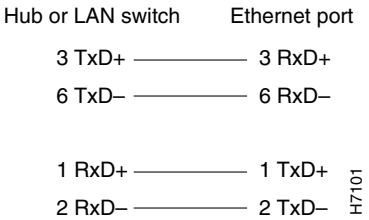
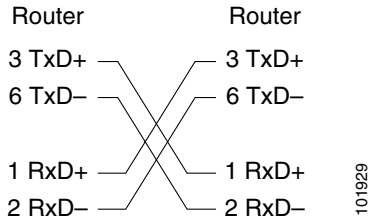


Figure 2-8 Crossover Cable Pinout, RJ-45 Connections Between Routers



1 Port 10-Gigabit Ethernet SPA Overview

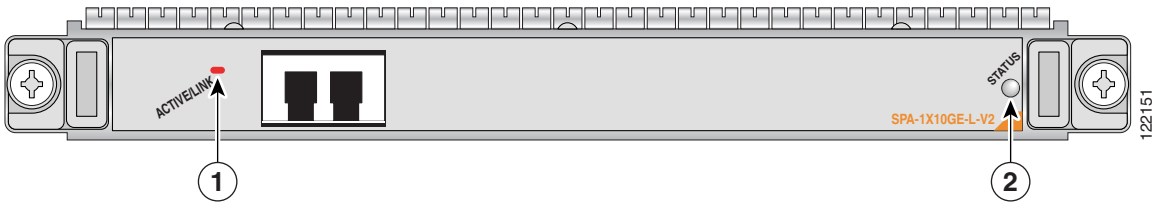
The following sections describe the 1-Port 10-Gigabit Ethernet SPA:

- 1-Port 10-Gigabit Ethernet SPA LEDs, page 2-13
- 1-Port 10-Gigabit Ethernet SPA XFP Optical Transceiver Modules, Connectors, and Cables, page 2-14

1-Port 10-Gigabit Ethernet SPA LEDs

The 1-Port 10-Gigabit Ethernet SPA has two LEDs, an ACTIVE/LINK LED for the port and a STATUS LED, as shown in Figure 2-9.

Figure 2-9 1-Port 10-Gigabit Ethernet SPA Faceplate



1	ACTIVE/LINK LED	**2**	STATUS LED

Table 2-11 describes the 1-Port 10-Gigabit Ethernet SPA LEDs.

Table 2-11 1-Port 10-Gigabit Ethernet SPA LEDs

LED Label	Color	State	Meaning
ACTIVE/LINK	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software and the link is up.
	Amber	On	Port is enabled by software and the link is down.
STATUS	Off	Off	SPA power is off.

Table 2-11 1-Port 10-Gigabit Ethernet SPA LEDs (continued)

LED Label	Color	State	Meaning
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

1-Port 10-Gigabit Ethernet SPA XFP Optical Transceiver Modules, Connectors, and Cables

The 1-Port 10-Gigabit Ethernet SPA supports the following types of optical transceiver modules:

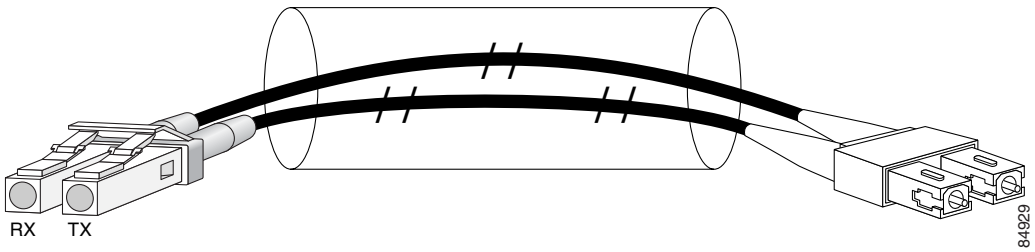
- Single-mode short-reach (SR) XFP module—XFP-10GLR
- Single-mode intermediate-reach (IR) XFP module—XFP-10GER
- Single-mode long-reach (LR) XFP module—XFP-10GZR

Cisco Systems qualifies the optics that are approved for use with its SPAs. As of Cisco IOS Release 12.0(32)SY, the above listed small form-factor pluggable (XFPs) are the only optical transceiver modules qualified for use.

Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns (nominal diameter is approximately 10/125 microns) to connect your router to a network.

Figure 2-10 shows the cable type for use with the XFP optical transceiver module on the 1-Port 10-Gigabit Ethernet SPA.

Figure 2-10 LC-Type Cable for the XFP Optical Transceiver Modules



Note The 40-pin connector on the 1-Port 10-Gigabit Ethernet SPA is used for resilient packet ring (RPR) connections. This feature is not supported in

XFP Connections

The XFP-10GLR-OC192SR, XFP-10GER-OC192IR, and XFP-10GZR-OC192LR XFPs include an optical transmitter and receiver pair integrated with Clock and Data Recovery (CDR) integrated circuits. The XFPs provide high-speed serial links at the following rates: 9.95 Gbps (OC-192) and 10.3125 Gbps (10 Gigabit Ethernet) on single mode fibers. The transmit side recovers and retimes the 10 Gbps serial data and passes it to a laser driver. The laser driver biases and modulates a 1310 nm or 1550 nm laser,

enabling data transmission over SMF through an LC connector. The receive side recovers and retimes the 10 Gbps optical data stream from a photo detector trans impedance amplifier and passes it to an output driver.

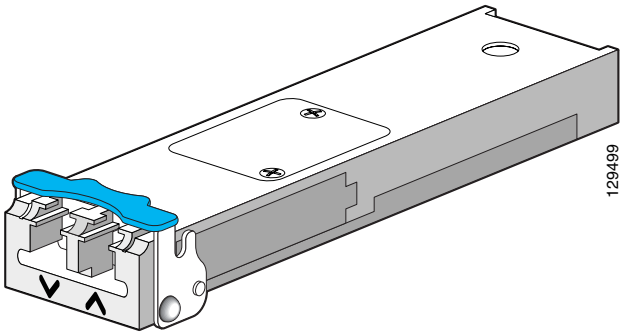
See the label on the XFP for technology type and model.

XFP dimensions are:

- Height 12.5 mm
- Width 18.35 mm
- Length 71.1mm

The XFP temperature range is 0°C to 70°C. For a picture of an XFP, see Figure 2-11.

Figure 2-11 XFP Illustration



XFP Port Cabling Specifications

Table 2-12 XFP Port Cabling Specifications

XFP	Wavelength	Fiber Type
XFP-10GLR-OC192SR	1310 nm	SMF
XFP-10GER-OC192IR	1550 nm	SMF
XFP-10GZR-OC192LR	1550 nm	SMF

2-Port Gigabit Ethernet SPA Overview

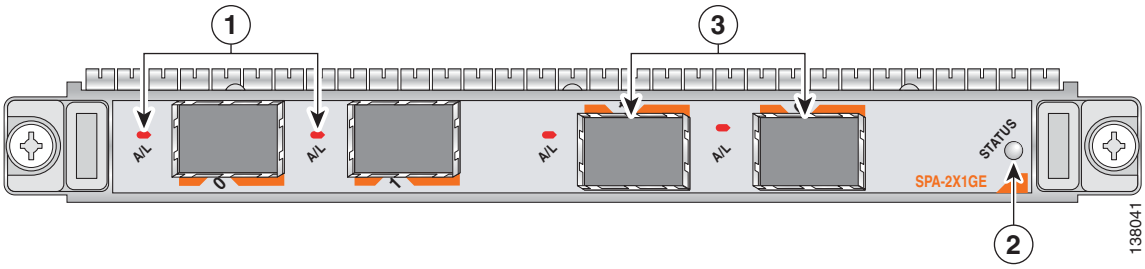
The following sections describe the version 1 and version 2 of the 2-Port Gigabit Ethernet SPA:

- 2-Port Gigabit Ethernet SPA LEDs, page 2-16
- 2-Port Gigabit Ethernet SPA (Version 2) LEDs, page 2-16
- SFP Module Cabling and Connection Equipment, page 2-20

2-Port Gigabit Ethernet SPA LEDs

The 2-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for each port and a STATUS LED, as shown in Figure 2-12.

Figure 2-12 2-Port Gigabit Ethernet SPA Faceplate



1	A/L (Active/Link) LED	2	STATUS LED

Table 2-13 describes the 2-Port Gigabit Ethernet SPA LEDs.

Table 2-13 2-Port Gigabit Ethernet SPA LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

2-Port Gigabit Ethernet SPA (Version 2) LEDs

The 2-Port Gigabit Ethernet SPA (Version 2) has two types of LEDs: an A/L LED for each port (SFP and RJ45) and a STATUS LED, as shown in Figure 2-13.

Figure 2-13 2-Port Gigabit Ethernet SPA (Version 2) Faceplate

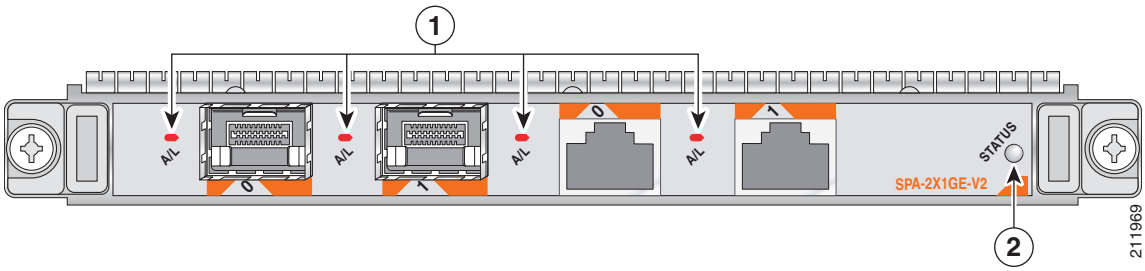


Table 2-14 describes the 2-Port Gigabit Ethernet SPA (Version 2) LEDs.

1	A/L (Active/Link) LED	**2**	STATUS LED

Table 2-14 2-Port Gigabit Ethernet SPA (Version 2) LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled by software and the link is up.
	Amber	On	Port is enabled by software and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

The valid configuration of the SFP and RJ45 ports for the 2-Port Gigabit Ethernet SPA (Version 2) are as follows:

- Port 0 (SFP) and Port 1 (SFP)
- Port 0 (SFP) and Port 1 (RJ45)
- Port 0 (RJ45) and Port 1 (SFP)
- Port 0 (RJ45) and Port 1 (RJ45)

or any single port

Note For Cisco XR 12000 Series Router, the RJ45 port is not supported on 2-Port Gigabit Ethernet SPA.

2-Port Fast Ethernet SPA Cables, Connectors, and Pinouts

The interface connectors on the 2-Port Fast Ethernet SPA are two individual RJ-45 receptacles. You can use both the interface connectors simultaneously. Each connection supports IEEE 802.3 and Ethernet 10/100BASE-T interfaces compliant with appropriate standards. Cisco Systems does not supply Category 5 unshielded twisted pair (UTP) RJ-45 cables. these cables are available commercially. The RJ-45 connectors are shown in Figure 2-14.

Figure 2-14 2-Port Fast Ethernet RJ-45 Connections, Plug, and Receptacle

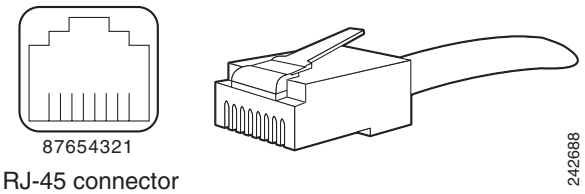


Table 2-15 lists the pinouts and signals for the RJ-45 connector.

Table 2-15 2-Port Fast Ethernet RJ-45 Connector Pinouts

Pin	Description
1	Transmit data + (TxD+)
2	TxD–
3	Receive data + (RxD+)
4	Reserved
5	Reserved
6	RxD–
7	Reserved
8	Reserved

2-Port Gigabit Ethernet SPA Cables and Connectors

The interface connectors on the 2-Port Gigabit Ethernet SPA are two individual fiber-optic receivers that support SFP modules. Each port can send and receive traffic using the optical fiber connections.

SFP Module Connections

The small form-factor pluggable (SFP) module is an input/output (I/O) device that plugs into the Gigabit Ethernet ports on the 2-Port Gigabit Ethernet SPA, linking the port with a fiber-optic network.

Note The 2-Port Gigabit Ethernet SPA will only accept the SFP modules listed as supported in this document. An SFP module check is run every time an SFP module is inserted into the 2-Port Gigabit Ethernet SPA and only SFP modules that pass this check will be usable by the 2-Port Gigabit Ethernet SPA.
SFP modules exist for technologies other than Gigabit Ethernet and for products other than the 2-Port Gigabit Ethernet SPA. However, the information in this document pertains only to SFP modules that plug into the 2-Port Gigabit Ethernet SPA ports.

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 2-16 and Table 2-17 provide SFP module information and specifications.

Table 2-16 SFP Module Options

SFP Module Product Number	SFP Module	Description
SFP-GE-S	Short wavelength (1000BASE-SX)	Contains a Class 1 laser of 850 nm for 1000BASE-SX (short wavelength) applications.
SFP-GE-L	Long wavelength/long haul (1000BASE-LX/LH)	Contains a Class 1 laser of 1310 nm for 1000BASE-LX/LH (long wavelength) applications.

Table 2-16 SFP Module Options

SFP Module Product Number	SFP Module	Description
SFP-GE-Z	Extended wavelength (1000BASE-ZX)	Contains a Class 1 laser of 1550 nm for 1000BASE-ZX (extended wavelength) applications.
SFP-GE-T	RJ-45 copper SFP module (1000BASE-T)	Provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure.

Table 2-17 SFP Module Specifications

Specification	Description
Wavelength	SFP-GE-S: 770 to 860 nm SFP-GE-L: 1270 to 1355 nm SFP-GE-Z: 1500 to 1580 nm SFP-GE-T: N/A.
Cabling distance (maximum)	SFP-GE-S: 500 m on 50/125um MMF; 300 m on 62.5/125um MMF SFP-GE-L: 6.2 miles (10 km) SFP-GE-Z: 49.7 miles (80 km) SFP-GE-T: 328 ft. (100 m)
Operating case temperature range	SFP-GE-S: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-L: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-Z: 23 to 185 degrees F (–5 to 85 degrees C)
Storage temperature range	SFP-GE-S: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-L: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-Z: –40 to 185 degrees F (–40 to 85 degrees C)
Supply voltage range	SFP-GE-S: 3.1 to 3.5 V SFP-GE-L: 3.1 to 3.5 V SFP-GE-Z: 3.1 to 3.5 V

SFP-GE-S Modules

The 1000BASE-SX (short wavelength) module operates on standard multimode fiber-optic link spans of up to 500 m on 50/125um MMF and 300 m on 62.5/125um MMF.

SFP-GE-L Modules

The 1000BASE-LX/LH (long wavelength/long haul) module interfaces fully comply with the IEEE 802.3z 1000BASE-LX standard. However, their higher optical quality allows them to reach 6.2 miles (10 km) over single-mode fiber (SMF) versus the 3.1 miles (5 km) specified in the standard.

SFP-GE-Z Modules

The 1000BASE-ZX (extended wavelength) module operates on ordinary single-mode fiber-optic link spans of up to 49.7 miles (80 km). Link spans of up to 62.1 miles (100 km) are possible using premium single-mode fiber or dispersion-shifted single-mode fiber (premium single-mode fiber has a lower attenuation per unit length than ordinary single-mode fiber; dispersion-shifted single-mode fiber has both lower attenuation and less dispersion).

The 1000BASE-ZX module must be coupled to single-mode fiber-optic cable, which is the type of cable typically used in long-haul telecommunications applications. The 1000BASE-ZX module will not operate correctly when coupled to multimode fiber, and it is not intended to be used in environments where multimode fiber is frequently used (for example, building backbones, or horizontal cabling).

The 1000BASE-ZX module is intended to be used as a Physical Medium Dependent (PMD) component for Gigabit Ethernet interfaces found on various switch and router products. It operates at a signaling rate of 1250 Mbaud, transmitting and receiving 8B/10B encoded data.

When shorter lengths of single-mode fiber are used, it may be necessary to insert an in-line optical attenuator in the link to avoid overloading the receiver.

- Insert a 10-dB in-line optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is less than 15.5 miles (25 km).
- Insert a 5-dB in-line optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is equal to or greater than 15.5 miles (25 km) but less than 31 miles (50 km).

SFP-GE-T Modules

The SFP-GE-T (1000BASE-T copper SFP module) provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure. The SFP-GE-T maximum cabling distance is 328 feet (100 m).

SFP Module Cabling and Connection Equipment

Table 2-18 provides cabling specifications for the SFP modules that can be installed on the 2-Port Gigabit Ethernet SPA. Note that all SFP ports have LC-type connectors.

The minimum cable distance for the SFP-GE-S is 6.5 feet (2 m), and the minimum link distance for the SFP-GE-Z is 6.2 miles (10 km) with an 8-dB attenuator installed at each end of the link. Without attenuators, the minimum link distance for the SFP-GE-Z is 24.9 miles (40 km).

Table 2-18 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-S	850	MMF[1]	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)

Table 2-18 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-L	1300	MMF[2] and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF[3]	8	—	62.1 miles (100 km)
SFP-GE-T	N/A	Copper	N/A	N/A	328 ft. (100 m)

1. Multimode fiber (MMF) only.
2. A mode-conditioning patch cord is required.
   When using the SFP-GE-L with 62.5-micron diameter MMF, you must install a mode-conditioning patch cord between the SFP module and the MMF cable on both the transmit and the receive ends of the link when link distances are greater than 984 ft (300 m).
   We do not recommend using the SFP-GE-L and MMF with no patch cord for very short link distance (tens of meters). The result could be an elevated bit error rate (BER).
3. Dispersion-shifted single-mode fiber-optic cable.

Note The 1000BASE-ZX SFP modules provide an optical power budget of 21.5 dB. You should measure your cable plant with an optical loss test set to verify that the optical loss of the cable plant (including connectors and splices) is less than or equal to 21.5 dB. The optical loss measurement must be performed with a 1550-nm light source.

5-Port Gigabit Ethernet SPA Overview

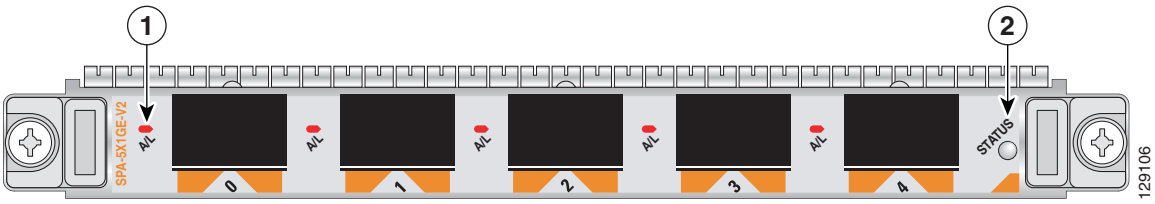
The following sections describe the 5-Port Gigabit Ethernet SPA:

- 5-Port Gigabit Ethernet SPA LEDs, page 2-21
- 5-Port Gigabit Ethernet SPA Cables and Connectors, page 2-22

5-Port Gigabit Ethernet SPA LEDs

The 5-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for each individual port and a STATUS LED for the SPA, as shown in Figure 2-15.

Figure 2-15 5-Port Gigabit Ethernet SPA Faceplate



1	A/L (Active/Link) LED	**2**	STATUS LED

Table 2-19 describes the 5-Port Gigabit Ethernet SPA LEDs.

Table 2-19 5-Port Gigabit Ethernet SPA LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

5-Port Gigabit Ethernet SPA Cables and Connectors

The 5-Port Gigabit Ethernet SPA has five electrical connectors that support SFP modules. Each port can send and receive traffic using cabling appropriate for the SFP module inserted.

SFP Module Connections

The small form-factor pluggable (SFP) module is an input/output (I/O) device that plugs into the Gigabit Ethernet ports on the 5-Port Gigabit Ethernet SPA, linking the port with a fiber-optic network.

Note The 5-Port Gigabit Ethernet SPA accepts only the SFP modules listed as supported in this document. An SFP module check is run every time an SFP module is inserted into the 5-Port Gigabit Ethernet SPA, and only SFP modules that pass this check can be used by the 5-Port Gigabit Ethernet SPA.
SFP modules exist for technologies other than Gigabit Ethernet and for products other than the 5-Port Gigabit Ethernet SPA. However, the information in this document pertains only to SFP modules that plug into the 5-Port Gigabit Ethernet SPA ports.

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 2-20 and Table 2-21 provide SFP module information and specifications.

Table 2-20 SFP Module Options

SFP Module Product Number	SFP Module	Description
SFP-GE-S	Short wavelength (1000BASE-SX)	Contains a Class 1 laser of 850 nm for 1000BASE-SX (short-wavelength) applications.
SFP-GE-L	Long wavelength/long haul (1000BASE-LX/LH)	Contains a Class 1 laser of 1310 nm for 1000BASE-LX/LH (long-wavelength) applications.
SFP-GE-Z	Extended wavelength (1000BASE-ZX)	Contains a Class 1 laser of 1550 nm for 1000BASE-ZX (extended-wavelength) applications.
SFP-GE-T	RJ-45 copper SFP module (1000BASE-T)	Provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure.

Table 2-21 SFP Module Specifications

Specification	Description
Wavelength	SFP-GE-S: 770 to 860 nm SFP-GE-L: 1270 to 1355 nm SFP-GE-Z: 1500 to 1580 nm SFP-GE-T: N/A.
Cabling distance (maximum)	SFP-GE-S: 500 m on 50/125um MMF; 300 m on 62.5/125um MMF SFP-GE-L: 6.2 miles (10 km) SFP-GE-Z: 49.7 miles (80 km) SFP-GE-T: 328 ft. (100 m)
Operating case temperature range	SFP-GE-S: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-L: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-Z: 23 to 185 degrees F (–5 to 85 degrees C)
Storage temperature range	SFP-GE-S: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-L: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-Z: –40 to 185 degrees F (–40 to 85 degrees C)
Supply voltage range	SFP-GE-S: 3.1 to 3.5 V SFP-GE-L: 3.1 to 3.5 V SFP-GE-Z: 3.1 to 3.5 V

SFP-GE-S Modules

The 1000BASE-SX (short-wavelength) module operates on standard multimode fiber-optic link spans of up to 500 m on 50/125um multimode fiber (MMF) and 300 m on 62.5/125um MMF.

SFP-GE-L Modules

The 1000BASE-LX/LH (long-wavelength/long-haul) module interfaces fully comply with the IEEE 802.3z 1000BASE-LX standard. However, their higher optical quality allows them to reach 6.2 miles (10 km) over single-mode fiber (SMF) versus the 3.1 miles (5 km) specified in the standard.

SFP-GE-Z Modules

The 1000BASE-ZX (extended wavelength) module operates on ordinary single-mode fiber-optic link spans of up to 49.7 miles (80 km). Link spans of up to 62.1 miles (100 km) are possible using premium single-mode fiber or dispersion-shifted single-mode fiber. (Premium single-mode fiber has a lower attenuation per unit length than ordinary single-mode fiber; dispersion-shifted single-mode fiber has both lower attenuation and less dispersion.)

The 1000BASE-ZX module must be coupled to single-mode fiber-optic cable, which is the type of cable typically used in long-haul telecommunications applications. The 1000BASE-ZX module does not operate correctly when coupled to multimode fiber, and it is not intended to be used in environments in which multimode fiber is frequently used (for example, building backbones or horizontal cabling).

The 1000BASE-ZX module is intended to be used as a Physical Medium Dependent (PMD) component for Gigabit Ethernet interfaces found on various switch and router products. It operates at a signaling rate of 1250 Mbaud, transmitting and receiving 8B/10B encoded data.

When shorter lengths of single-mode fiber are used, it may be necessary to insert an inline optical attenuator in the link to avoid overloading the receiver. Use the following guidelines:

- Insert a 10-dB inline optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is less than 15.5 miles (25 km).
- Insert a 5-dB inline optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is equal to or greater than 15.5 miles (25 km) but less than 31 miles (50 km).

SFP-GE-T Modules

The SFP-GE-T (1000BASE-T copper SFP module) provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure. The SFP-GE-T maximum cabling distance is 328 feet (100 m).

SFP Module Cabling and Connection Equipment

Table 2-22 provides cabling specifications for the SFP modules that can be installed on the 5-Port Gigabit Ethernet SPA. Note that all SFP ports have LC-type connectors.

The minimum cable distance for the SFP-GE-S is 6.5 feet (2 m), and the minimum link distance for the SFP-GE-Z is 6.2 miles (10 km) with an 8-dB attenuator installed at each end of the link. Without attenuators, the minimum link distance for the SFP-GE-Z is 24.9 miles (40 km).

Table 2-22 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-S	850	MMF[1]	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)

Table 2-22 SFP Module Port Cabling Specifications (continued)

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-L	1300	MMF[2] and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF[3]	8	—	62.1 miles (100 km)
SFP-GE-T	N/A	Copper	N/A	N/A	328 ft. (100 m)

1. Multimode fiber (MMF) only.
2. A mode-conditioning patch cord is required.
   When using the SFP-GE-L with 62.5-micron diameter MMF, you must install a mode-conditioning patch cord between the SFP module and the MMF cable on both the transmit and the receive ends of the link when link distances are greater than 984 ft (300 m).
   We do not recommend using the SFP-GE-L and MMF with no patch cord for very short link distance (tens of meters). The result could be an elevated bit error rate (BER).
3. Dispersion-shifted single-mode fiber-optic cable.

Note The 1000BASE-ZX SFP modules provide an optical power budget of 21.5 dB. You should measure your cable plant with an optical loss test set to verify that the optical loss of the cable plant (including connectors and splices) is less than or equal to 21.5 dB. The optical loss measurement must be performed with a 1550-nm light source.

10-Port Gigabit Ethernet SPA Overview

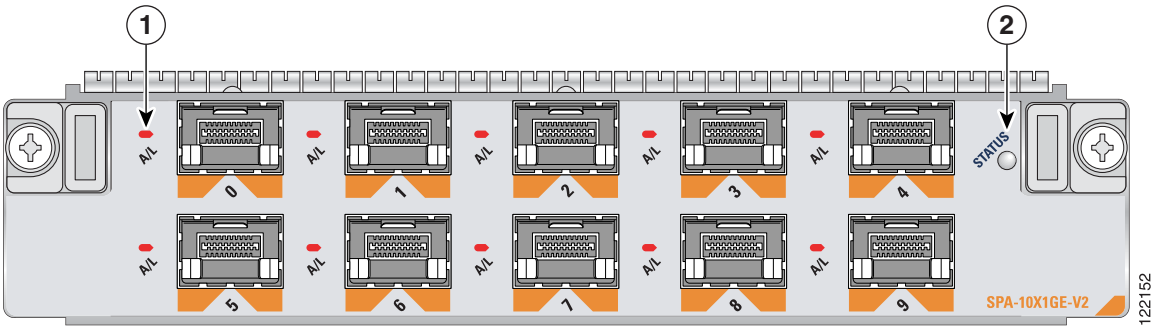
The following sections describe the 10-Port Gigabit Ethernet SPA:

- 10-Port Gigabit Ethernet SPA LEDs, page 2-26
- 10-Port Gigabit Ethernet SPA Cables and Connectors, page 2-26

10-Port Gigabit Ethernet SPA LEDs

The 10-Port Gigabit Ethernet SPA has two types of LEDs: an A/L LED for the port and a STATUS LED, as shown in Figure 2-16.

Figure 2-16 10-Port Gigabit Ethernet SPA Faceplate



1	A/L (Active/Link) LED	**2**	STATUS LED

Table 2-23 describes the 10-Port Gigabit Ethernet SPA LEDs.

Table 2-23 10-Port Gigabit Ethernet SPA LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

10-Port Gigabit Ethernet SPA Cables and Connectors

The 10-Port Gigabit Ethernet SPA has ten electrical connectors which support SFPs modules. Each port can send and receive traffic using cabling appropriate for the SFP module inserted.

SFP Module Connections

The small form-factor pluggable (SFP) module is an input/output (I/O) device that plugs into the Gigabit Ethernet optical slots on the 10-Port Gigabit Ethernet SPA, linking the port with a 1000BASE-X fiber-optic network.

Note The 10-Port Gigabit Ethernet SPA will only accept the SFP modules listed as supported in this document. An SFP module check is run every time an SFP is inserted into the 10-Port Gigabit Ethernet SPA and only SFP modules that pass this check will be usable by the 10-Port Gigabit Ethernet SPA.
SFP modules exist for technologies other than Gigabit Ethernet and for products other than the 10-Port Gigabit Ethernet SPA. However, the information in this document pertains only to SFP modules that plug into the 10-Port Gigabit Ethernet SPA ports.

The SFP module has a receiver port (RX) and a transmitter port (TX) that compose one optical interface. Table 2-24 and Table 2-25 provide SFP information and specifications.

Table 2-24 SFP Module Options

SFP Module Product Number	SFP Module	Description
SFP-GE-S	Short wavelength (1000BASE-SX)	Contains a Class 1 laser of 850 nm for 1000BASE-SX (short-wavelength) applications.
SFP-GE-L	Long wavelength/long haul (1000BASE-LX/LH)	Contains a Class 1 laser of 1310 nm for 1000BASE-LX/LH (long-wavelength) applications.
SFP-GE-Z	Extended wavelength (1000BASE-ZX)	Contains a Class 1 laser of 1550 nm for 1000BASE-ZX (extended-wavelength) applications.
SFP-GE-T	RJ-45 copper SFP module (1000BASE-T)	Provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure.

Table 2-25 SFP Module Specifications

Specification	Description
Wavelength	SFP-GE-S: 770 to 860 nm SFP-GE-L: 1270 to 1355 nm SFP-GE-Z: 1500 to 1580 nm SFP-GE-T: N/A.
Cabling distance (maximum)	SFP-GE-S: 500 m on 50/125um MMF; 300 m on 62.5/125um MMF SFP-GE-L: 6.2 miles (10 km) SFP-GE-Z: 49.7 miles (80 km) SFP-GE-T: 328 ft. (100 m)
Operating case temperature range	SFP-GE-S: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-L: 23 to 185 degrees F (–5 to 85 degrees C) SFP-GE-Z: 23 to 185 degrees F (–5 to 85 degrees C)
Storage temperature range	SFP-GE-S: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-L: –40 to 185 degrees F (–40 to 85 degrees C) SFP-GE-Z: –40 to 185 degrees F (–40 to 85 degrees C)
Supply voltage range	SFP-GE-S: 3.1 to 3.5 V SFP-GE-L: 3.1 to 3.5 V SFP-GE-Z: 3.1 to 3.5 V

SFP-GE-S Modules

The 1000BASE-SX (short wavelength) module operates on standard multimode fiber-optic link spans of up to 500 m on 50/125um MMF and 300 m on 62.5/125um MMF.

SFP-GE-L Modules

The 1000BASE-LX/LH (long wavelength/long haul) module interfaces fully comply with the IEEE 802.3z 1000BASE-LX standard. However, their higher optical quality allows them to reach 6.2 miles (10 km) over single-mode fiber (SMF) versus the 3.1 miles (5 km) specified in the standard.

SFP-GE-Z Modules

The 1000BASE-ZX (extended wavelength) module operates on ordinary single-mode fiber-optic link spans of up to 49.7 miles (80 km). Link spans of up to 62.1 miles (100 km) are possible using premium single-mode fiber or dispersion-shifted single-mode fiber (premium single-mode fiber has a lower attenuation per unit length than ordinary single-mode fiber; dispersion-shifted single-mode fiber has both lower attenuation and less dispersion).

The 1000BASE-ZX module must be coupled to single-mode fiber-optic cable, which is the type of cable typically used in long-haul telecommunications applications. The 1000BASE-ZX module will not operate correctly when coupled to multimode fiber, and it is not intended to be used in environments where multimode fiber is frequently used (for example, building backbones, or horizontal cabling).

The 1000BASE-ZX module is intended to be used as a Physical Medium Dependent (PMD) component for Gigabit Ethernet interfaces found on various switch and router products. It operates at a signaling rate of 1250 Mbaud, transmitting and receiving 8B/10B encoded data.

When shorter lengths of single-mode fiber are used, it may be necessary to insert an in-line optical attenuator in the link to avoid overloading the receiver. Use the following guidelines:

- Insert a 10-dB in-line optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is less than 15.5 miles (25 km).
- Insert a 5-dB in-line optical attenuator between the fiber-optic cable plant and the receiving port on the 1000BASE-ZX module at each end of the link whenever the fiber-optic cable span is equal to or greater than 15.5 miles (25 km) but less than 31 miles (50 km).

SFP-GE-T Modules

The SFP-GE-T (1000BASE-T copper SFP module) provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure. The SFP-GE-T maximum cabling distance is 328 feet (100 m).

SFP Module Cabling and Connection Equipment

Table 2-26 provides cabling specifications for the SFP modules that can be installed on the 10-Port Gigabit Ethernet SPA. Note that all SFP ports have LC-type connectors.

The minimum cable distance for the SFP-GE-S is 6.5 feet (2 m), and the minimum link distance for the SFP-GE-Z is 6.2 miles (10 km) with an 8-dB attenuator installed at each end of the link. Without attenuators, the minimum link distance for the SFP-GE-Z is 24.9 miles (40 km).

Table 2-26 SFP Module Port Cabling Specifications

SFP Modules	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
SFP-GE-S	850	MMF[1]	62.5	160	722 ft (220 m)
			62.5	200	984 ft (300 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)
SFP-GE-L	1300	MMF[2] and SMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
			9/10	—	6.2 miles (10 km)
SFP-GE-Z	1550	SMF	9/10	—	49.7 miles (80 km)
		SMF[3]	8	—	62.1 miles (100 km)
SFP-GE-T	N/A	Copper	N/A	N/A	328 ft. (100 m)

1. Multimode fiber (MMF) only.
2. A mode-conditioning patch cord is required.
   When using the SFP-GE-L with 62.5-micron diameter MMF, you must install a mode-conditioning patch cord between the SFP module and the MMF cable on both the transmit and the receive ends of the link when link distances are greater than 984 ft (300 m).
   We do not recommend using the SFP-GE-L and MMF with no patch cord for very short link distance (tens of meters). The result could be an elevated bit error rate (BER).
3. Dispersion-shifted single-mode fiber-optic cable.

Note The 1000BASE-ZX SFP modules provide an optical power budget of 21.5 dB. You should measure your cable plant with an optical loss test set to verify that the optical loss of the cable plant (including connectors and splices) is less than or equal to 21.5 dB. The optical loss measurement must be performed with a 1550-nm light source.

1-Port Channelized STM-1/OC-3 SPA Overview

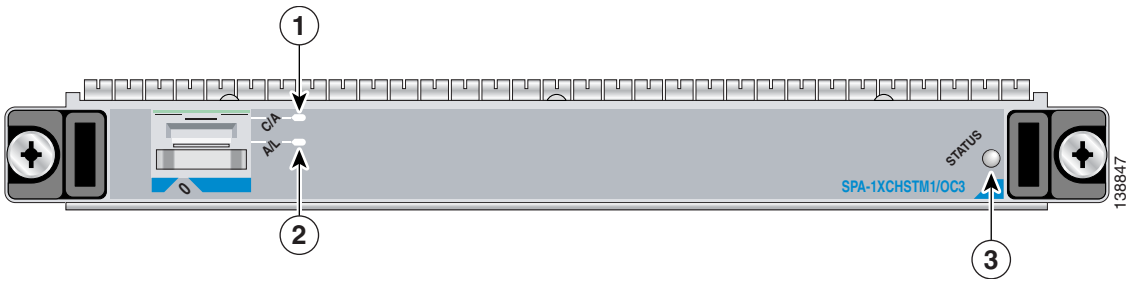
The following sections describe the 1-Port Channelized STM-1/OC-3 SPA:

- 1-Port Channelized STM-1/OC-3 SPA LEDs, page 2-30
- 1-Port Channelized STM-1/OC-3 SPA Interface Specifications, page 2-30
- 1-Port Channelized STM-1/OC-3 SPA Cables and Connectors, page 2-31

1-Port Channelized STM-1/OC-3 SPA LEDs

The 1-Port Channelized STM-1/OC-3 SPA has two types of LEDs: an A/L LED for each port and a STATUS LED, as shown in Figure 2-17.

Figure 2-17 1-Port Channelized STM-1/OC-3 SPA Faceplate



1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port Channelized STM-1/OC-3 SPALEDs are described in Table 2-27.

Table 2-27 1-Port Channelized STM-1/OC-3 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

1-Port Channelized STM-1/OC-3 SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-3/STM-1 line rates (155.52 Mbps).

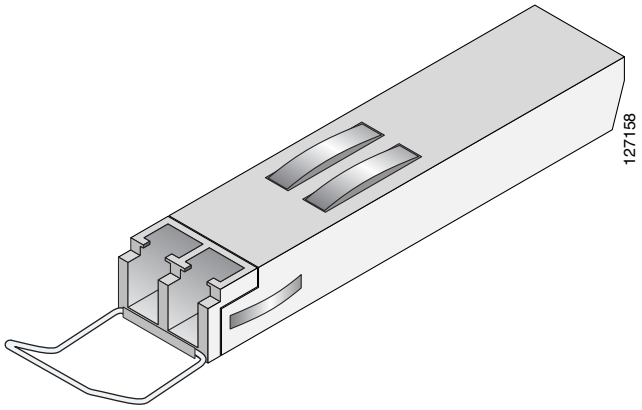
Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-3/STM-1 frame.

The 1-Port Channelized STM-1/OC-3 SPA interface is compliant with RFC 1619, *PPP over SONET/SDH*, and RFC 1662, *PPP in HDLC-like Framing*. The 1-Port Channelized STM-1/OC-3 SPA also provides support for SNMP v1 agent (RFC 1155–1157), and Management Information Base (MIB) II (RFC 1213).

1-Port Channelized STM-1/OC-3 SPA Cables and Connectors

The 1-Port Channelized STM-1/OC-3 SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see Figure 2-18).

Figure 2-18 SFP Optics Module



The SFP optical transceiver modules used with the 1-Port Channelized STM-1/OC-3 SPA provide the following optical fiber options:

- Multimode—155-Mbps, OC-3/STM-1 optical fiber (SONET STS-3 or SDH STM-1)

  Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- Single-mode—155-Mbps, OC-3/STM-1 optical fiber (SONET STS-3 or SDH STM-1)

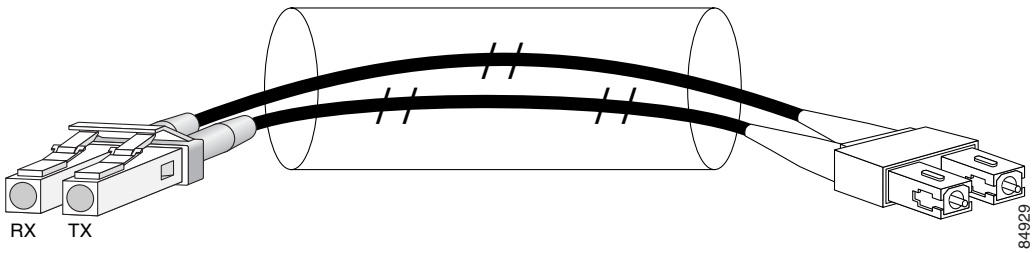
  Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-19) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 1-Port Channelized STM-1/OC-3 SPA-equipped routers back to back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between the two of them.

Figure 2-19 LC Type Cables



1-Port Channelized STM-4/OC-12 SPA Overview

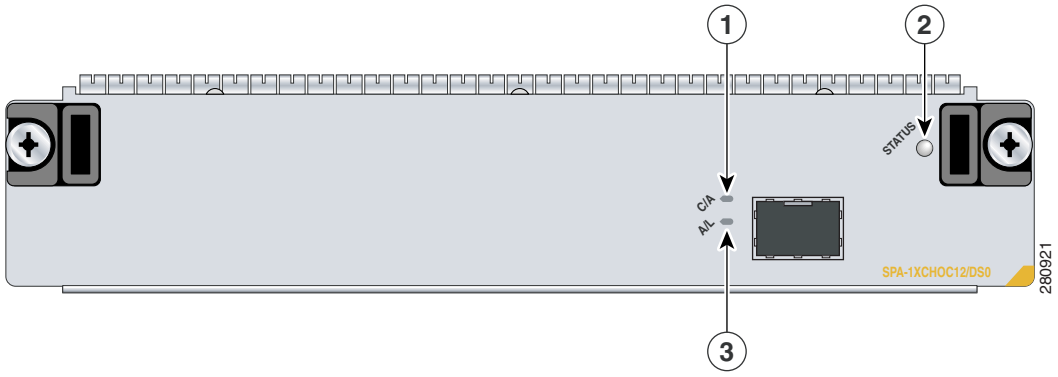
The following sections describe the 1-Port Channelized STM-4/OC-12 SPA:

- 1-Port Channelized STM-4/OC-12 SPA LEDs, page 2-32
- 1-Port Channelized STM-4/OC-12 SPA Interface Specifications, page 2-33
- 1-Port Channelized STM-4/OC-12 SPA Cables and Connectors, page 2-33

1-Port Channelized STM-4/OC-12 SPA LEDs

The 1-Port Channelized STM-4/OC-12 SPA has two types of LEDs: an A/L LED for each port and a STATUS LED, as shown in Figure 2-20.

Figure 2-20 1-Port Channelized STM-4/OC-12 SPA Faceplate



1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port Channelized STM-4/OC-12 SPALEDs are described in Table 2-28.

Table 2-28 1-Port Channelized STM-4/OC-12 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

1-Port Channelized STM-4/OC-12 SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-12/STM-4 line rates (622.08 Mbps).

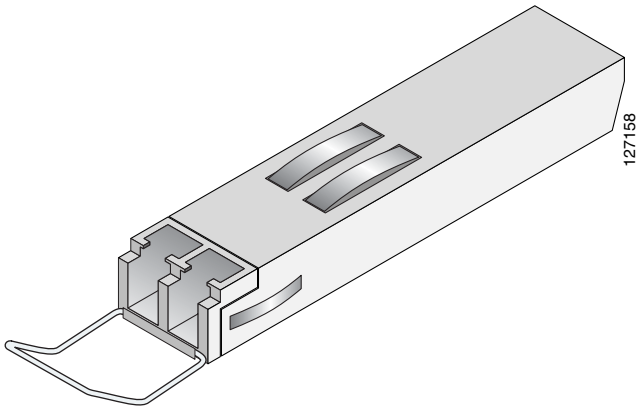
Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-12/STM-4 frame.

The 1-Port Channelized STM-4/OC-12 SPA interface is compliant with RFC 1619, *PPP over SONET/SDH*, and RFC 1662, *PPP in HDLC-like Framing*. The 1-Port Channelized STM-4/OC-12 SPA also provides support for SNMP v1 agent (RFC 1155–1157), and Management Information Base (MIB) II (RFC 1213).

1-Port Channelized STM-4/OC-12 SPA Cables and Connectors

The 1-Port Channelized STM-4/OC-12 SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see Figure 2-21).

Figure 2-21 SFP Optics Module



The SFP optical transceiver modules used with the 1-Port Channelized STM-4/OC-12 SPA provide the following optical fiber options:

- Multimode—622-Mbps, OC-12/STM-4 optical fiber (SONET STS-12 or SDH STM-4)

  Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.

- Single-mode—622-Mbps, OC-12/STM-4 optical fiber (SONET STS-12 or SDH STM-4)

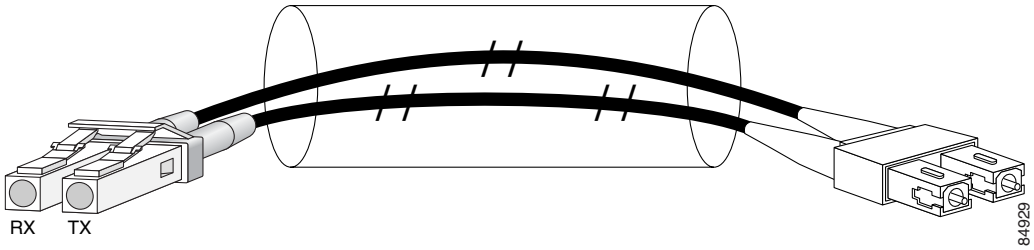
  Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-22) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 1-Port Channelized STM-4/OC-12 SPA-equipped routers back to back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between the two of them.

Figure 2-22 LC Type Cables



1-Port Channelized STM-16/OC-48 SPA Overview

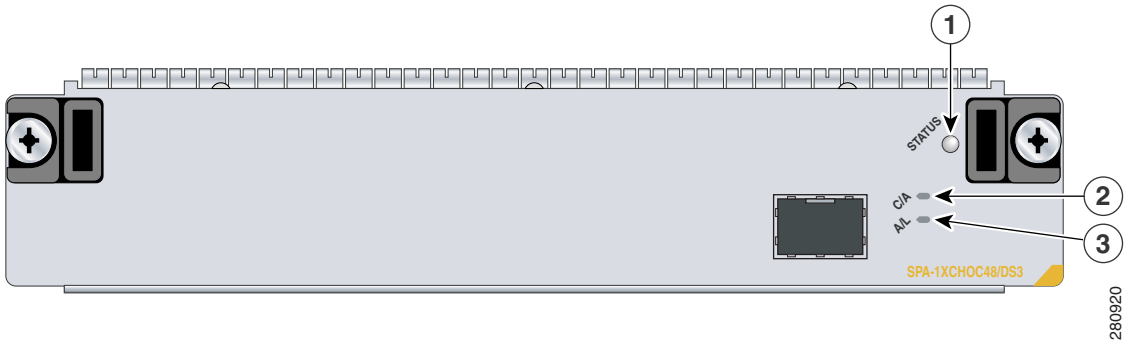
The following sections describe the 1-Port Channelized STM-4/OC-12 SPA:

- 1-Port Channelized STM-16/OC-48 SPA LEDs, page 2-34
- 1-Port Channelized STM-16/OC-48 SPA Interface Specifications, page 2-35
- 1-Port Channelized STM-16/OC-48 SPA Cables and Connectors, page 2-35

1-Port Channelized STM-16/OC-48 SPA LEDs

The 1-Port Channelized STM-16/OC-48 SPA has two types of LEDs: an A/L LED for each port and a STATUS LED, as shown in Figure 2-23.

Figure 2-23 1-Port Channelized STM-16/OC-48 SPA Faceplate



1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port Channelized STM-16/OC-48 SPALEDs are described in Table 2-29.

Table 2-29 1-Port Channelized STM-16/OC-48 SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid T3 signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

1-Port Channelized STM-16/OC-48 SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-48/STM-16 line rates (2.488 Gbps).

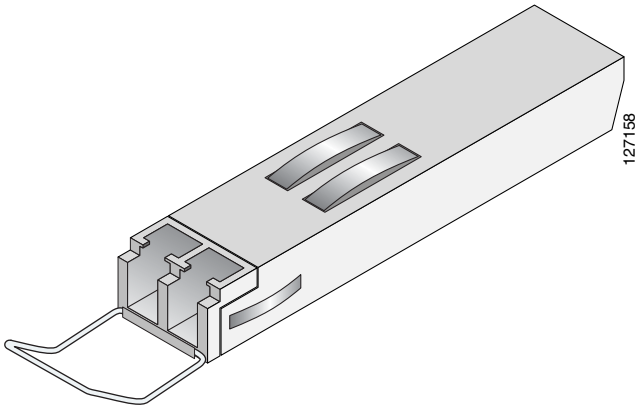
Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-48/STM-16 frame.

The 1-Port Channelized STM-16/OC-48 SPA interface is compliant with RFC 1619, *PPP over SONET/SDH*, and RFC 1662, *PPP in HDLC-like Framing*. The 1-Port Channelized STM-16/OC-48 SPA also provides support for SNMP v1 agent (RFC 1155–1157), and Management Information Base (MIB) II (RFC 1213).

1-Port Channelized STM-16/OC-48 SPA Cables and Connectors

The 1-Port Channelized STM-16/OC-48 SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see Figure 2-24).

Figure 2-24 SFP Optics Module



The SFP optical transceiver modules used with the 1-Port Channelized STM-16/OC-48 SPA provide the following optical fiber options:

- Multimode—2.488-Gbps, OC-48/STM-16 optical fiber (SONET STS-48 or SDH STM-16)

  Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.

- Single-mode—2.488-Gbps, OC-48/STM-16 optical fiber (SONET STS-48 or SDH STM-16)

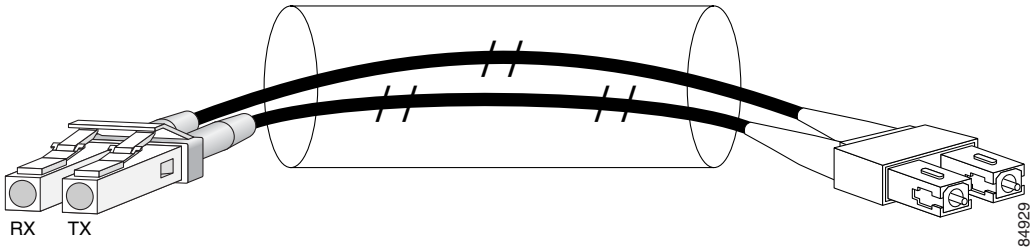
  Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-25) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 1-Port Channelized STM-16/OC-48 SPA-equipped routers back to back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between the two of them.

Figure 2-25 LC Type Cables



1-Port OC-192/STM-64 POS SPA Overview

The 1-Port OC-192/STM-64 POS/RPR SPA is a double-height SPA that is installed in two SIP subslots. The 1-Port OC-192/STM-64 POS/RPR SPA provides SONET and SDH network connectivity with a bandwidth of 9.95 Gbps.

For more information about SPA bandwidth, see the "Bandwidth Oversubscription" section on page 2-2. For more information about SPAs and their compatibility with SIPs and modular optics, see the "SIP and SPA Compatibility" chapter in this guide.

The 1-Port OC-192/STM-64 POS/RPR SPA uses a single,10-Gbps fixed optical receptacle allowing a connection to single-mode optical fiber. For more information on the optical fiber cables used with this SPA, see the "1-Port OC-192/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables" section on page 2-39.

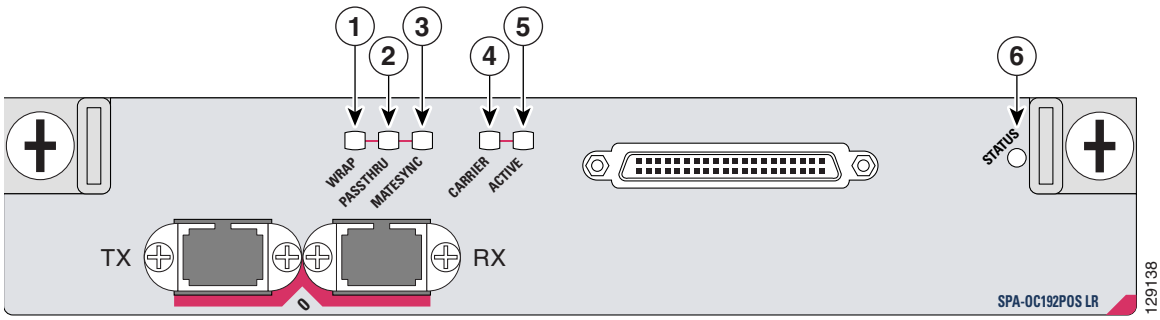
The following sections describe the 1-Port OC-192/STM-64 POS/RPR SPA:

- 1-Port OC-192/STM-64 POS/RPR SPA LEDs, page 2-37
- 1-Port OC-192/STM-64 POS/RPR SPA Interface Specifications, page 2-38
- 1-Port OC-192/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables, page 2-39

1-Port OC-192/STM-64 POS/RPR SPA LEDs

The 1-Port OC-192/STM-64 POS/RPR SPA has six LEDs, as shown in Figure 2-26.

Figure 2-26 1-Port OC-192/STM-64 POS/RPR SPA Faceplate



1	WRAP LED	**4**	CARRIER LED
2	PASSTHRU LED	**5**	ACTIVE LED
3	MATESYNC LED	**6**	STATUS LED

Note The WRAP, PASSTHRU, and MATESYNC LEDs apply to the SPA in RPR/SRP mode only. In Cisco IOS Release 12.0(31)S, RPR/SRP mode is not supported.

The 1-Port OC-192/STM-64 POS/RPR SPA LEDs are described in Table 2-30.

Table 2-30 1-Port OC-192/STM-64 POS/RPR SPA LEDs

LED Label	Color	State	Meaning
WRAP	Off	Off	Port is not in wrap mode.
	Green	On	Port is in wrap mode somewhere on the ring.
	Amber	On	Port is in wrap mode locally.
PASSTHRU	Off	Off	Port is not in pass-thru mode.
	Amber	On	Port is in pass-thru mode.
MATESYNC	Off	Off	Mate port is not synchronized.
	Green	On	Mate port is synchronized.
CARRIER	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software; there is a valid SONET signal without alarms.
	Amber	On	Port is enabled by software; there is at least one alarm (LOS, LOF, RDI, and so on).
		Blinking	Indicates SRP mode mismatch alarm.
ACTIVE	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software; loopback is off.
	Amber	On	Port is enabled by software; loopback is on.
STATUS	Off	Off	SPA power off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good; SPA is being configured.

1-Port OC-192/STM-64 POS/RPR SPA Interface Specifications

The 1-Port OC-192/STM-64 POS/RPR SPA contains a SONET/SDH framer to process incoming and outgoing SONET or SDH frames. The framer operates at OC-192/STM-64 line rates (9.95 Gbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-192/STM-64 frame.

The 1-Port OC-192/STM-64 POS/RPR SPA interface is compliant with the following RFCs:

- RFC 1619, *PPP over SONET/SDH*
- RFC 1662, *PPP in HDLC-like Framing*
- *RFC 2615, PPP over SONET/SDH*

The 1-Port OC-192/STM-64 POS/RPR SPA also provides support for SNMP v1 agent (RFC 1155–1157) and RFC 1213:

- RFC 1155, *Structure and Identification of Management Information for TCP/IP-Based Internets*
- RFC 1156, *Management Information Base for Network Management of TCP/IP-Based Internets*
- RFC 1157, *Simple Network Management Protocol (SNMP)*

- RFC 1213, *Management Information Base (MIB) for Network Management of TCP/IP-Based Internets:MIB II*

1-Port OC-192/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables

The 1-Port OC-192/STM-64 POS/RPR SPA uses fixed optical transceivers, one for receive (RX) and one for transmit (TX), for SONET and SDH connection to the network. In Cisco IOS Release 12.0(31)S, only long-reach (LR) optics are supported.

Cisco Systems qualifies the optics that are approved for use with its SPAs. As of Cisco IOS Release 12.0(31)S Cisco IOS XR Software Release 3.2, the XFP-10GLR-OC192SR and the XFP-10GER-OC192IR are the only optical transceiver modules qualified for use.

The 1-Port OC-192/STM-64 POS/RPR SPA uses single-mode SC-type connectors:

- Single-mode—9.95 Gbps, OC-192 optical fiber (SONET STS-192 or SDH STM-64c)

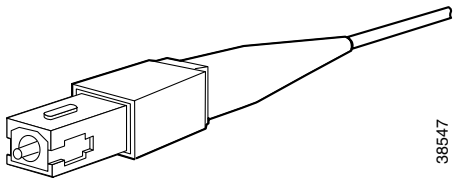
Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns. (Nominal diameter is approximately 10/125 microns.)

Use a single-mode optical fiber cable to connect your router to a network.

Note The 40-pin connector on the 1-Port OC-192/STM-64 POS/RPR SPA is used for resilient packet ring (RPR) connections. This feature is not supported in Cisco IOS Release 12.0(31)S.

Figure 2-27 shows the cable type for use with the fixed optical transceiver module on the 1-Port OC-192/STM-64 POS/RPR SPA.

Figure 2-27 SC-Type Connectors for the Fixed Optical Transceivers



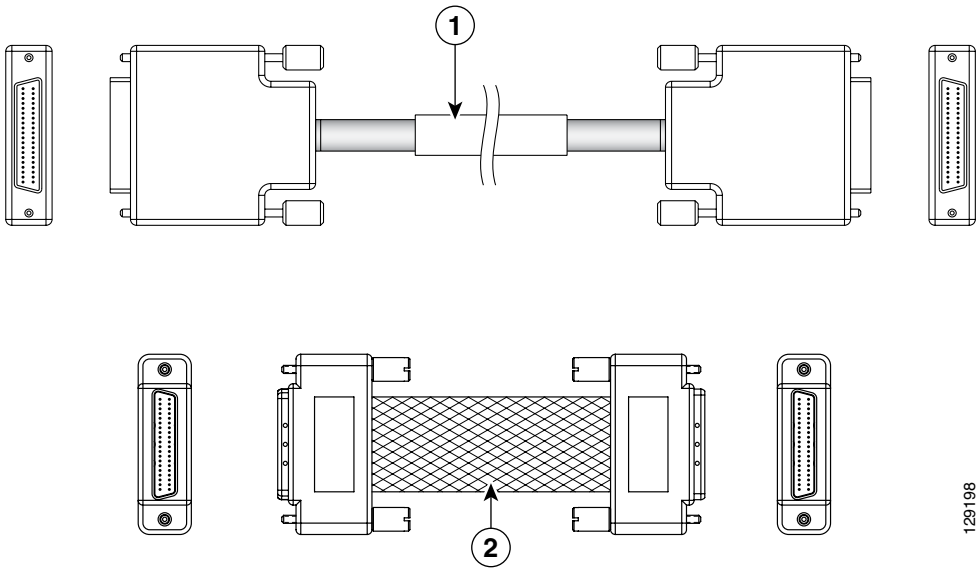
Mate Interface Cables

The 1-Port OC-192/STM-64 POS/RPR SPA supports two mate interface configurations:

- Mate between two OC-192 SPAs in the same SIP
- Mate between two OC-192 SPAs in adjacent SIPs

Two 1-Port OC-192/STM-64 POS/RPR SPAs are connected using a 40–pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-28 shows the mate cables used to connect the SPAs.

Figure 2-28 SPA Mate Cables



1	Long length RPR mate cable for single port RPR SPAs (CBL-RPR-OC192-L)	**2**	Short length RPR mate cable for single port RPR SPAs (CAB-RPR-OC192-S)

Note The RPR mate cable is necessary only when the SPA is to be used in RPR mode. It is not needed in POS mode. Support for the RPR feature is dependent on the platform software release feature content. Verify support for the RPR feature support by reviewing the relevant SPA datasheets or by contacting your Cisco representative.

1-Port OC-192 STM-64 POS RPR XFP SPA Overview

The 1-Port OC-192/STM-64 POS/RPR XFP SPA is a single-height SPA that is installed in one SIP subslot. The 1-Port OC-192/STM-64 POS/RPR XFP SPA provides SONET and SDH network connectivity with a bandwidth of 9.95 Gbps.

For more information about SPA bandwidth, see the "Bandwidth Oversubscription" section in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the product overview chapter in this guide.

The 1-Port OC-192/STM-64 POS/RPR XFP SPA uses a 10-Gbps small form-factor pluggable optical receptacle for each port allowing connection to single-mode optical fiber. For more information on the optical fiber cables used with this SPA, see the "1-Port OC-192/STM-64 POS/RPR SPA Fixed Optical Transceiver, 40-Pin Connector, and Cables" section on page 2-39.

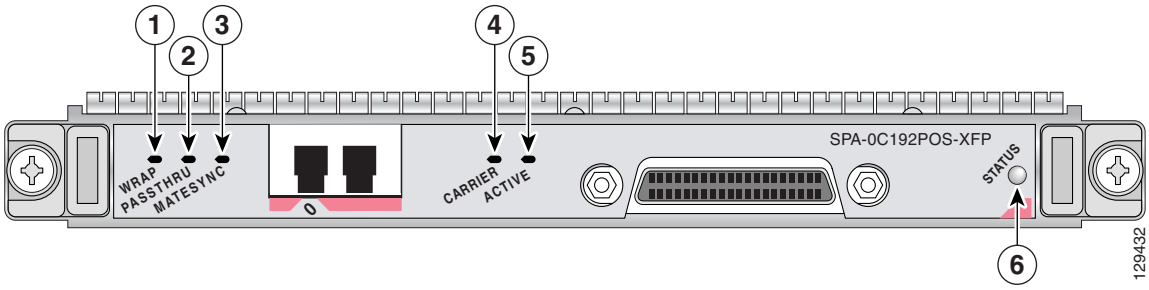
The following sections describe the 1-Port OC-192/STM-64 POS/RPR XFP SPA:

- 1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs, page 2-41
- 1-Port OC-192/STM-64 POS/RPR XFP SPA Interface Specifications, page 2-42
- 1-Port OC-192/STM-64 POS/RPR XFP SPA Optical Transceiver Modules, Connectors, and Cables, page 2-42

1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs

The 1-Port OC-192/STM-64 POS/RPR XFP SPA has six LEDs, as shown in Figure 2-29.

Figure 2-29 1-Port OC-192/STM-64 POS/RPR XFP SPA Faceplate



1	WRAP LED	**4**	CARRIER LED
2	PASSTHRU LED	**5**	ACTIVE LED
3	MATESYNC LED	**6**	STATUS LED

Note The WRAP, PASSTHRU, and MATESYNC LEDs apply to the SPA in RPR/SRP mode only. As of Cisco IOS XR Software Release 3.4.0, RPR/SRP mode is not supported.

Table 2-31 describes the 1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs.

Table 2-31 1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs

LED Label	Color	State	Meaning
WRAP	Off	Off	Port is not in wrap mode.
	Green	On	Port is in wrap mode somewhere on the ring.
	Amber	On	Port is in wrap mode locally.
PASSTHRU	Off	Off	Port is not in pass-thru mode.
	Amber	On	Port is in pass-thru mode.
MATESYNC	Off	Off	Mate port is not synchronized.
	Green	On	Mate port is synchronized.
CARRIER	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm (LOS, LOF, RDI, and so on).
		Blinking	SRP mode mismatch alarm is indicated.

Table 2-31 1-Port OC-192/STM-64 POS/RPR XFP SPA LEDs (continued)

LED Label	Color	State	Meaning
ACTIVE	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.
STATUS	Off	Off	SPA power off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

1-Port OC-192/STM-64 POS/RPR XFP SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-192/STM-64 line rates (9.95 Gbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-192/STM-64 frame.

The 1-Port OC-192/STM-64 POS/RPR XFP SPA interface is compliant with the following RFCs:

- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2615, *PPP over SONET/SDH*

For information on SNMP MIB support, see "Implementing SNMP on Cisco IOS XR Software" in *Cisco IOS XR System Management Configuration Guide*.

1-Port OC-192/STM-64 POS/RPR XFP SPA Optical Transceiver Modules, Connectors, and Cables

The 1-Port OC-192/STM-64 POS/RPR XFP SPA uses a single-mode, 9.95 Gbps, OC-192 optical fiber (SONET STS-192 or SDH STM-64) optical transceiver module for SONET and SDH connection to the network.

The 1-Port OC-192/STM-64 POS/RPR XFP SPA supports the following types of optical transceiver module:

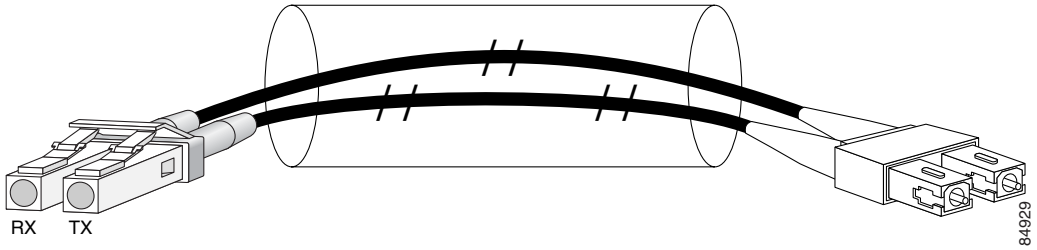
- Single-mode short-reach (SR) XFP module—XFP-10GLR-OC192SR
- Single-mode intermediate-reach (IR) XFP module—XFP-10GER-OC192IR
- Single-mode very-long reach XFP module—XFP-10GZR-OC192LR

Cisco Systems qualifies the optics that are approved for use with its SPAs. As of Cisco IOS XR Software Release 3.4.0, the above-listed XFPs are the only optical transceiver modules qualified for use.

Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns (nominal diameter is approximately 10/125 microns) to connect your router to a network.

Figure 2-30 shows the cable type for use with the XFP optical transceiver module on the 1-Port OC-192/STM-64 POS/RPR XFP SPA.

Figure 2-30 LC-Type Cable for the XFP Optical Transceiver Modules



Note The 40-pin connector on the 1-Port OC-192/STM-64 POS/RPR XFP SPA is used for resilient packet ring (RPR) connections. This feature is not supported in Cisco IOS XR Software Release 3.4.0.

OC-192 Module Connections

Table 2-32 shows the OC-192 specifications for use with the 1-Port OC-192/STM-64 POS/RPR XFP SPA.

Table 2-32 OC-192 Specifications

Specification	Description
Wavelength	OC-192 SR-1: 1290 nm to 1330 nm OC-192 IR-2: 1530 nm to 1565 nm OC-192 LR-2: 1530 nm to 1565 nm
Cabling distance (maximum)	OC-192 SR-1: 2 km (1.2 miles) OC-192 IR-2: 40 km (24.8 miles) OC-192 LR-2: 50 miles (80 km)
Operating case temperature range	OC-192 SR-1: 23 to 158 degrees F (–5 to 70 degrees C) OC-192 IR-2: 23 to 158 degrees F (–5 to 70 degrees C) OC-192 LR-2: 23 to 158 degrees F (–5 to 70 degrees C)
Tx Power	OC-192 SR-1: –6 dBm –1 dBm OC-192 IR-2: –1 dBm +2 dBm OC-192 LR-2: 0 to +4 dBm
Receiver Sensitivity (maximum)	OC-192 SR-1: –11 dBm OC-192 IR-2: –14 dBm OC-192 LR-2: –24 dBm
RX Overload	OC-192 SR-1: –1 dBm OC-192 IR-2: +2 dBm OC-192 LR-2: –7.0 dBm
Maximum Receiver Power Damage	OC-192 SR-1: +5 dBm OC-192 IR-2: +5 dBm OC-192 LR-2: +5 dBm

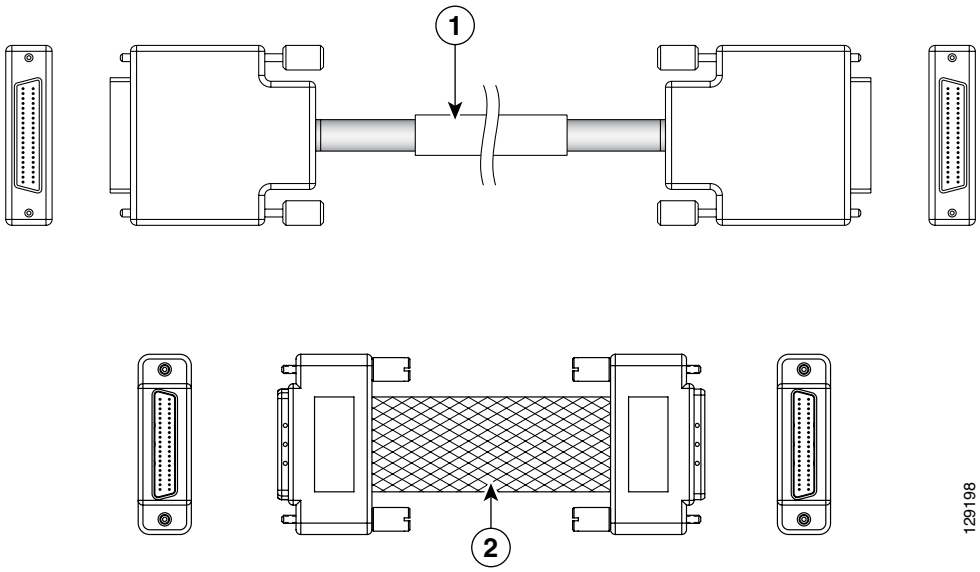
Mate Interface Cables

The 1-Port OC-192/STM-64 POS/RPR XFP SPA supports two mate interface configurations:

- Mate between two OC-192 SPAs in the same SIP
- Mate between two OC-192 SPAs in adjacent SIPs

Two 1-Port OC-192/STM-64 POS/RPR XFP SPAs are connected using a 40–pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-31 shows the mate cables used to connect the SPAs.

Figure 2-31 SPA Mate Cables



1	Long length RPR mate cable for single port RPR SPAs (CBL-RPR-OC192-L)	**2**	Short length RPR mate cable for single port RPR SPAs (CAB-RPR-OC192-S)

Note The RPR mate cable is necessary only when the SPA is to be used in RPR mode. It is not needed in POS mode. Support for the RPR feature is dependent on the platform software release feature content. Verify support for the RPR feature support via SPA datasheets or by contacting your Cisco representative.

4-Port OC-3/STM-1 POS SPA Overview

The 2-Port and 4-Port OC-3/STM-1 POS SPA is a single-height SPA that installs into one SIP subslot. The OC-3c/STM-1 POS SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity with a per-port bandwidth of 155.52 Mbps. The 2-Port and 4-Port OC-3/STM-1 POS SPA operates at quarter rate.

Note When SFP modules are replaced, the SPA interface retains any previously defined configurations. These configurations include settings for IP address, clock source, loopback, CRC, and POS flags.

For more information about SPA bandwidth, see the "Bandwidth Oversubscription" topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the "SIP and SPA Product Overview" chapter in this guide.

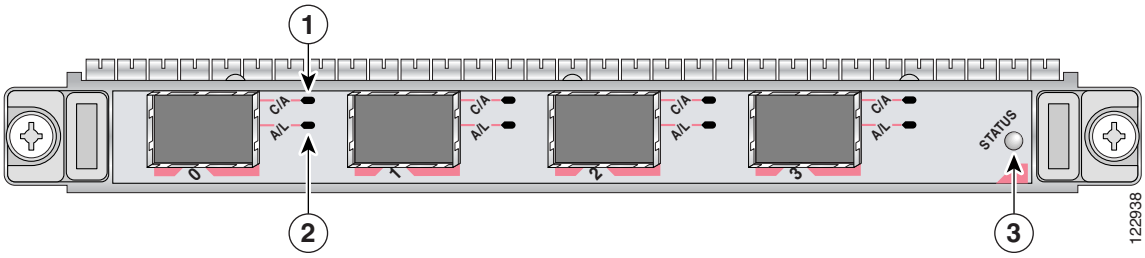
The following sections describe the 2-Port and 4-Port OC-3/STM-1 POS SPA:

- 2-Port and 4-Port OC-3/STM-1 POS SPA LEDs, page 2-45
- 2-Port and 4-Port OC-3/STM-1 POS SPA Interface Specifications, page 2-46
- 2-Port and 4-Port OC-3/STM-1 POS SPA Optical Transceiver Modules and Cables, page 2-46

2-Port and 4-Port OC-3/STM-1 POS SPA LEDs

The 2-Port and 4-Port OC-3/STM-1 POS SPA has three types of LEDs: two LEDs for each port on the SPA and one STATUS LED. Figure 2-32 shows the 4-Port OC-3/STM-1 POS SPA.

Figure 2-32 4-Port OC-3/STM-1 POS SPA Faceplate



1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active/Loopback) LED		

Table 2-33 describes the 2-Port and 4-Port OC-3/STM-1 POS SPA LEDs.

Table 2-33 2-Port and 4-Port OC-3/STM-1 POS SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	SONET controller is shut down.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Interface is shut down.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.

Table 2-33 2-Port and 4-Port OC-3/STM-1 POS SPA LEDs (continued)

LED Label	Color	State	Meaning
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

2-Port and 4-Port OC-3/STM-1 POS SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-3c/STM-1 line rates (155.52 Mbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-3c/STM-1 frame.

The 2-Port and 4-Port OC-3/STM-1 POS SPA interface complies with the following RFCs:

- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2427, *Multiprotocol Interconnect over Frame Relay*
- RFC 2615, *PPP over SONET/SDH*

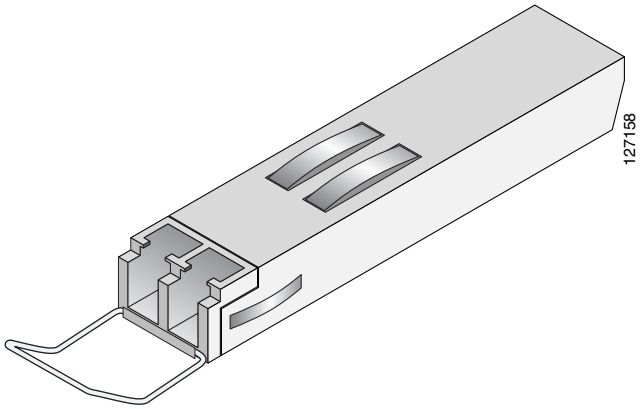
2-Port and 4-Port OC-3/STM-1 POS SPA Optical Transceiver Modules and Cables

The 2-Port and 4-Port OC-3/STM-1 POS SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see Figure 2-33).

Cisco Systems qualifies the optics that are approved for use with its SPAs. The 2-Port and 4-Port OC-3/STM-1 POS SPA supports the following types of optical transceiver modules:

- Multimode (MM) SFP module—SFP-OC3-MM
- Short-reach (SR) SFP module—SFP-OC3-SR
- Intermediate-reach (IR) SFP module (15 km)—SFP-OC3-IR1
- Long-reach (LR) SFP module (40 km)—SFP-OC3-LR1
- Long-reach (LR) SFP module (80 km)—SFP-OC3-LR2

Figure 2-33 SFP Optics Module



The SFP optical transceiver modules used with the 2-Port and 4-Port OC-3/STM-1 POS SPA provide the following optical fiber options:

- Multimode—155-Mbps, OC-3c/STM-1 optical fiber (SONET STS-3c or SDH STM-1)

  Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.

- Single-mode—155-Mbps, OC-3c/STM-1 optical fiber (SONET STS-3c or SDH STM-1)

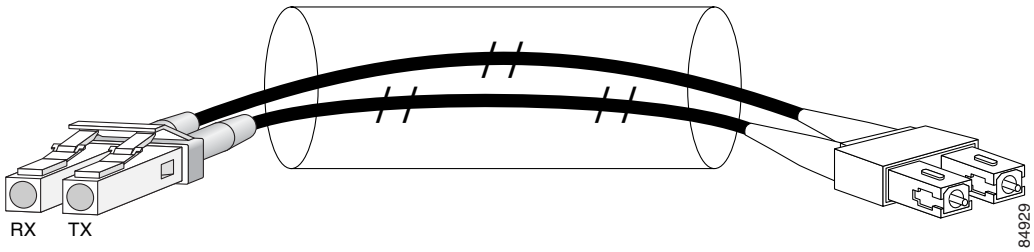
  Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-34) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 2-Port and 4-Port OC-3/STM-1 POS SPA-equipped routers back-to-back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between them.

Figure 2-34 LC-Type Cable



OC-3 Module Connections

Table 2-34 shows the OC-3 specifications of the optics on the 2-Port and 4-Port OC-3/STM-1 POS SPA.

Table 2-34 OC-3 Specifications

Specification	Description
Wavelength	OC-3 MM: 1270 nm to 1380 nm OC-3 SR: 1260 nm to 1360 nm OC-3 IR-1: 1261 nm to 1360 nm OC-3 LR-1: 1263 nm to1360 nm OC-3 LR-2: 1480 nm to 1580 nm
Cabling distance (maximum)	OC-3 MM: 2 km (1.2 miles) OC-3 SR: 2 km (1.2 miles) OC-3 IR-1: 15 km (9.3 miles) OC-3 LR-1: 40 km (24.8 miles) OC-3 LR-2: 80 km (49.7 miles)
Operating case temperature range	OC-3 MM: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 SR: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 IR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-2: 23 to 185 degrees F (–5 to 85 degrees C)
TX power	OC-3 MM: –19 to –14 dBm OC-3 SR: –15 to –8 dBm OC-3 IR-1: –15 to –8 dBm OC-3 LR-1: –5 to 0 dBm OC-3 LR-2: –5 to 0 dBm
Receiver sensitivity (maximum)	OC-3 MM: –30 dBm OC-3 SR: –23 dBm OC-3 IR-1: –28 dBm OC-3 LR-1: –34 dBm OC-3 LR-2: –34 dBm
RX overload	OC-3 MM: –5 dBm OC-3 SR: –8 dBm OC-3 IR-1: –8 dBm OC-3 LR-1: –10 dBm OC-3 LR-2: –10 dBm
Maximum receiver power damage	OC-3 MM: +5 dBm OC-3 SR: +5 dBm OC-3 IR-1: +5 dBm OC-3 LR-1: +5 dBm OC-3 LR-2: +5 dBm

8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Overview

The 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA is a single-height SPA that installs into one SIP subslot. The SPA with small form-factor pluggable (SFP) optical transceiver modules provides Optical Carrier Level (OC-*n*) for SONET and Synchronous Transport Module (STM-*n*) for SDH network connectivity. On this SPA, any given port can use either an OC-3 or OC-12 SFP module, so the per-port bandwidth can be either 155.52 Mbps or 622.08 Mbps, respectively, depending on the customer configuration.

Note When SFP modules are replaced, the SPA interface retains any previously defined configurations. These configurations include settings for IP address, clock source, loopback, CRC, and POS flags.

For more information about SPA bandwidth, see the "Bandwidth Oversubscription" topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the "SIP and SPA Product Overview" chapter in this guide.

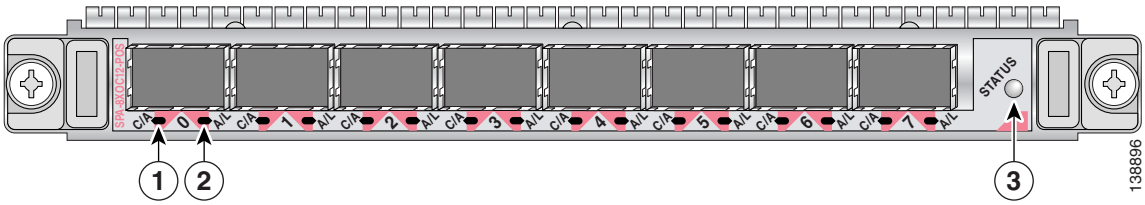
The following sections describe the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

- 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs, page 2-49
- 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Interface Specifications, page 2-50
- 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Optical Transceiver Modules and Cables, page 2-50

8-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs

The 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA has three types of LEDs: two LEDs for each port on the SPA and one STATUS LED. Figure 2-35 shows the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA faceplate.

Figure 2-35 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Faceplate



1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active/Loopback) LED		

Table 2-35 describes the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs.

Table 2-35 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	SONET controller is shut down.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Interface is shut down.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-3 line rates (155.52 Mbps) and OC-12 line rates (622.08 Mbps). Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the Layer 2 frame.

The 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA interface complies with the following RFCs:

- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2427, *Multiprotocol Interconnect over Frame Relay*
- RFC 2615, *PPP over SONET/SDH*

8-Port OC-3 STM-1/OC-12 STM-4 POS SPA Optical Transceiver Modules and Cables

The 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connections (see Figure 2-36).

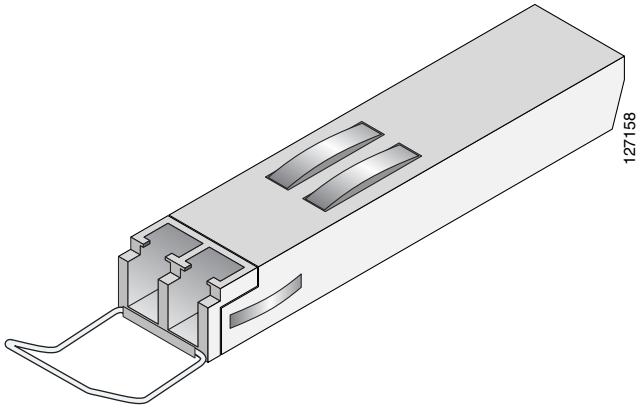
Cisco Systems qualifies the optics that are approved for use with its SPAs. The following OC-3 optical transceiver modules are supported on the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

- Multimode (MM) SFP module—SFP-OC3-MM
- Short-reach (SR) SFP module—SFP-OC3-SR
- Intermediate-reach (IR) SFP module (15 km)—SFP-OC3-IR1
- Long-reach (LR) SFP module (40 km)—SFP-OC3-LR1
- Long-reach (LR) SFP module (80 km)—SFP-OC3-LR2

The following OC-12 optical transceiver modules are supported on the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

- Multimode (MM) SFP module—SFP-OC12-MM
- Short-reach (SR) SFP module—SFP-OC12-SR
- Intermediate-reach (IR) SFP module (15 km)—SFP-OC12-IR1
- Long-reach (LR) SFP module (40 km)—SFP-OC12-LR1
- Long-reach (LR) SFP module (80 km)—SFP-OC12-LR2

Figure 2-36 SFP Optics Module



The following OC-3 optical fiber options are available for the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

- Multimode—155.52-Mbps, OC-3 optical fiber (SONET STS-3c or SDH STM-1)

  Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- Single-mode—155.52-Mbps, OC-3 optical fiber (SONET STS-3c or SDH STM-1)

  Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

The following OC-12 optical fiber options are available for the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA:

- Multimode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)

  Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.
- Single-mode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)

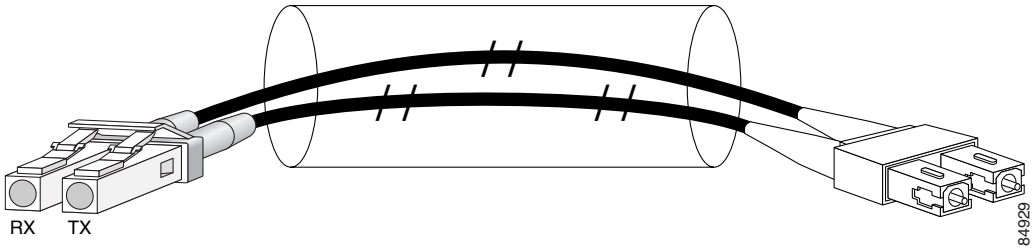
  Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-37) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for short-, intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or two OC-3-equipped or OC-12-equipped routers back-to-back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between them.

Figure 2-37 LC-Type Cable



OC-3 Module Connections

Table 2-36 shows the OC-3 specifications of the optics on the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA.

Table 2-36 OC-3 Specifications

Specification	Description
Wavelength	OC-3 MM: 1270 nm to 1380 nm OC-3 SR: 1260 nm to 1360 nm OC-3 IR-1: 1261 nm to 1360 nm OC-3 LR-1: 1263 nm to1360 nm OC-3 LR-2: 1480 nm to 1580 nm
Cabling distance (maximum)	OC-3 MM: 2 km (1.2 miles) OC-3 SR: 2 km (1.2 miles) OC-3 IR-1: 15 km (9.3 miles) OC-3 LR-1: 40 km (24.8 miles) OC-3 LR-2: 80 km (49.7 miles)
Operating case temperature range	OC-3 MM: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 SR: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 IR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-3 LR-2: 23 to 185 degrees F (–5 to 85 degrees C)
TX power	OC-3 MM: –19 to –14 dBm OC-3 SR: –15 to –8 dBm OC-3 IR-1: –15 to –8 dBm OC-3 LR-1: –5 to 0 dBm OC-3 LR-2: –5 to 0 dBm
Receiver sensitivity (maximum)	OC-3 MM: –30 dBm OC-3 SR: –23 dBm OC-3 IR-1: –28 dBm OC-3 LR-1: –34 dBm OC-3 LR-2: –34 dBm

Table 2-36 OC-3 Specifications (continued)

Specification	Description
RX overload	OC-3 MM: –5 dBm OC-3 SR: –8 dBm OC-3 IR-1: –8 dBm OC-3 LR-1: –10 dBm OC-3 LR-2: –10 dBm
Maximum receiver power damage	OC-3 MM: +5 dBm OC-3 SR: +5 dBm OC-3 IR-1: +5 dBm OC-3 LR-1: +5 dBm OC-3 LR-2: +5 dBm

OC-12 Module Connections

Table 2-37 shows the OC-12 specifications of the optics on the 8-Port OC-3 STM-1/OC-12 STM-4 POS SPA.

Table 2-37 OC-12 Specifications

Specification	Description
Wavelength	OC-12 MM: 1270 nm to 1380 nm OC-12 SR: 1261 nm to 1360 nm OC-12 IR-1: 1293 nm to 1334 nm OC-12 LR-1: 1280 nm to 1335 nm OC-12 LR-2: 1480 nm to 1580 nm
Cabling distance (maximum)	OC-12 MM: 0.5 km (0.3 miles) OC-12 SR: 2 km (1.2 miles) OC-12 IR-1: 15 km (9.3 miles) OC-12 LR-1: 40 km (24.8 miles) OC-12 LR-2: 80 km (49.7 miles)
Operating case temperature range	OC-12 MM: 23 to 185 degrees F (–5 to 85 degrees C) OC-12 SR: 23 to 185 degrees F (–5 to 85 degrees C) OC-12 IR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-12 LR-1: 23 to 185 degrees F (–5 to 85 degrees C) OC-12 LR-2: 23 to 185 degrees F (–5 to 85 degrees C)
TX power	OC-12 MM: –20 to –14 dBm OC-12 SR: –15 to –8 dBm OC-12 IR-1: –15 to –8 dBm OC-12 LR-1: –3 to 2 dBm OC-12 LR-2: –3 to 2 dBm
Receiver sensitivity (maximum)	OC-12 MM: –26 dB OC-12 SR: –23 dBm OC-12 IR-1: –28 dBm OC-12 LR-1: –28 dBm OC-12 LR-2: –28 dBm

Table 2-37 OC-12 Specifications (continued)

Specification	Description
RX overload	OC-12 MM: –6 dBm OC-12 SR: –8 dBm OC-12 IR-1: –8 dBm OC-12 LR-1: –8 dBm OC-12 LR-2: –8 dBm
Maximum receiver power damage	OC-12 MM: +5 dBm OC-12 SR: +5 dBm OC-12 IR-1: +5 dBm OC-12 LR-1: +5 dBm OC-12 LR-2: +5 dBm

1-Port OC-12/STM-4 POS SPA Overview

The 1-Port OC-12/STM-4 POS SPA is single-height SPA that installs into one SIP subslot. The 1-Port OC-12/STM-4 POS SPA with a small form-factor pluggable (SFP) optical transceiver module provides SONET and SDH network connectivity with a bandwidth of 622.08 Mbps.

For more information about SPA bandwidth, see the "Bandwidth Oversubscription" topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the "SIP and SPA Product Overview" chapter in this guide.

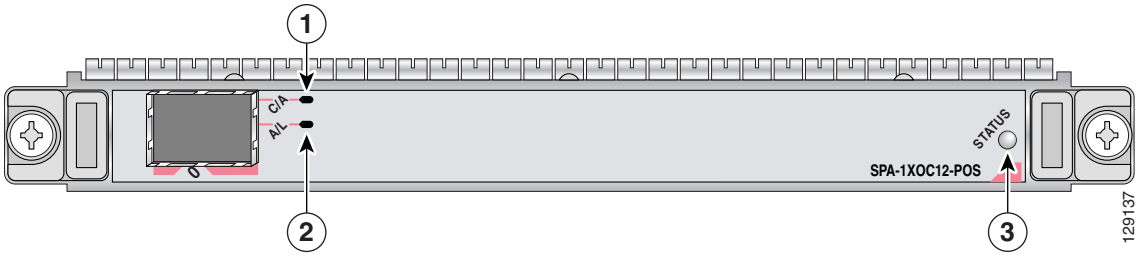
The following sections describe the 1-Port OC-12/STM-4 POS SPA:

- 1-Port OC-12/STM-4 POS SPA LEDs, page 2-54
- 1-Port OC-12/STM-4 POS SPA Interface Specifications, page 2-55
- 1-Port OC-12/STM-4 POS SPA SFP Optical Transceiver Modules and Cables, page 2-55

1-Port OC-12/STM-4 POS SPA LEDs

The 1-Port OC-12/STM-4 POS SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 2-38 shows an example of these LEDs on a 1-Port OC-12/STM-4 POS SPA.

Figure 2-38 1-Port OC-12/STM-4 POS SPA Faceplate



1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port OC-12/STM-4 POS SPA LEDs are described in Table 2-38.

Table 2-38 1-Port OC-12/STM-4 POS SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good; SPA is being configured.

1-Port OC-12/STM-4 POS SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-12/STM-4 line rates (622.08 Mbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-12/STM-4 frame.

The 1-Port OC-12/STM-4 POS SPA interface is compliant with the following RFCs:

- RFC 1619, *PPP over SONET/SDH*
- RFC 1662, *PPP in HDLC-like Framing*

The 1-Port OC-12/STM-4 POS SPA also provides support for SNMP v1 agent (RFC 1155–1157) and RFC 1213:

- RFC 1155, *Structure and Identification of Management Information for TCP/IP-based Internets*
- RFC 1156, *Management Information Base for Network Management of TCP/IP-Based Internets*
- RFC 1157, *Simple Network Management Protocol (SNMP)*
- RFC 1213, *Management Information Base (MIB) for Network Management of TCP/IP-Based Internets:MIB II*.

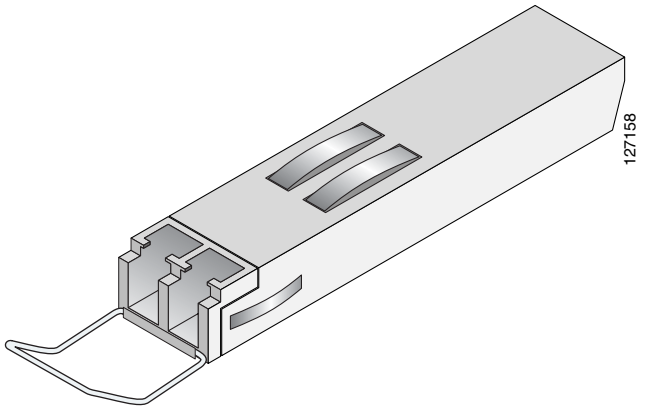
1-Port OC-12/STM-4 POS SPA SFP Optical Transceiver Modules and Cables

The POS SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see Figure 2-39).

Cisco Systems qualifies the optics that are approved for use with its SPAs. The 1-Port OC-12/STM-4 POS SPA supports the following types of optical transceiver modules:

- Multimode (MM) SFP module—SFP-OC12-MM
- Short reach (SR) SFP module—SFP-OC12-SR
- Intermediate reach (IR) SFP module (15 km)—SFP-OC12-IR1
- Long reach (LR) SFP module (40 km)—SFP-OC12-LR1
- LR SFP module (80 km)—SFP-OC12-LR2

Figure 2-39 SFP Optics Module



The SFP optical transceiver modules used with the POS SPAs provide the following optical fiber options:

- Multimode—622.08-Mbps, OC-12 optical fiber (SONET STS-12 or SDH STM-4)

  Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.

- Single-mode—622.08-Mbps, OC-12 optical fiber (SONET STS-12 or SDH STM-4)

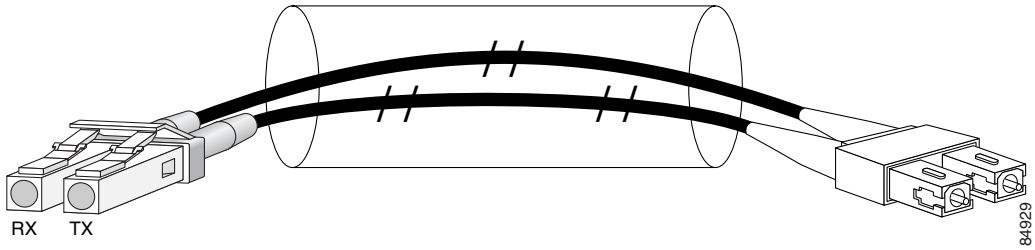
  Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-40) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use single-mode (for intermediate- or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two 1-Port OC-12/STM-4 POS SPA-equipped routers back to back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between the two of them.

Figure 2-40 LC-Type Cable



1-Port OC-48/STM-16 POS SPA Overview

The 1-Port OC-48/STM-16 POS SPA is a single-height SPA that is installed in a SIP subslot. The 1-Port OC-48/STM-16 POS SPA provides RPR over SONET (IEEE 802.17), SRP over SONET (Cisco Proprietary), and Packet over SONET (POS) network connectivity with a bandwidth of 9.95 Gbps.

For more information about SPA bandwidth, see the "Bandwidth Oversubscription" topic in this chapter. For more information about SPAs and their compatibility with SIPs and modular optics, see the "SIP and SPA Product Overview" chapter in this guide.

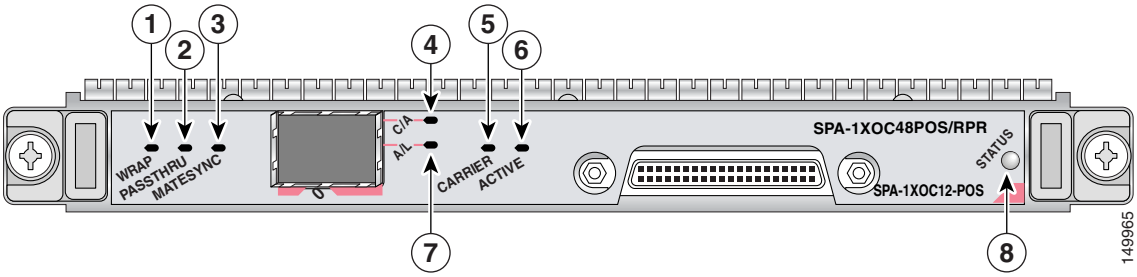
The following sections describe the 1-Port OC-48/STM-16 POS SPA:

- 1-Port OC-48/STM-16 POS SPA LEDs, page 2-57
- 1-Port OC-48/STM-16 POS SPA Interface Specifications, page 2-58
- 1-Port OC-48/STM-16 POS SPA Optical Transceiver Modules, Connectors, and Cables, page 2-59

1-Port OC-48/STM-16 POS SPA LEDs

The 1-Port OC-48/STM-16 POS SPA has six LEDs, as shown in Figure 2-41.

Figure 2-41 1-Port OC-48/STM-16 POS SPA Faceplate



1	WRAP LED	**5**	CARRIER LED
2	PASSTHRU LED	**6**	ACTIVE LED
3	MATESYNC LED	**7**	A/L (Active Loopback) LED
4	C/A (Carrier/Alarm) LED	**8**	STATUS LED

Note The WRAP, PASSTHRU, and MATESYNC LEDs apply to the SPA in RPR/SRP mode only.

The 1-Port OC-48/STM-16 POS SPA LEDs are described in Table 2-39.

Table 2-39 1-Port OC-48/STM-16 POS SPA LEDs

LED Label	Color	State	Meaning
WRAP	Off	Off	Port is not in wrap mode.
	Green	On	Port is in wrap mode somewhere on the ring.
	Amber	On	Port is in wrap mode locally.
PASSTHRU	Off	Off	Port is not in pass-thru mode.
	Amber	On	Port is in pass-thru mode.
MATESYNC	Off	Off	Mate port is not synchronized.
	Green	On	Mate port is synchronized.
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
CARRIER	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software; there is a valid SONET signal without alarms.
	Amber	On	Port is enabled by software; there is at least one alarm (LOS, LOF, RDI, and so on).
		Blinking	Indicates SRP mode mismatch alarm.
ACTIVE	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software; loopback is off.
	Amber	On	Port is enabled by software; loopback is on.
STATUS	Off	Off	SPA power off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good; SPA is being configured.

1-Port OC-48/STM-16 POS SPA Interface Specifications

The framer processes incoming and outgoing SONET or SDH frames. The framer operates at OC-48/STM-64 line rates (9.95 Gbps).

Packet data is transported with a user-configured encapsulation (such as Point-to-Point Protocol [PPP]) and is mapped into the STS-48/STM-64 frame.

The 1-Port OC-48/STM-16 POS SPA interface is compliant with the following RFCs:

- RFC 2615, *PPP over SONET/SDH*
- RFC 1662, *PPP in HDLC-like Framing*
- RFC 2615, *PPP over SONET/SDH*

1-Port OC-48/STM-16 POS SPA Optical Transceiver Modules, Connectors, and Cables

The 1-Port OC-48/STM-16 POS SPA uses a single-mode, 9.95 Gbps, OC-48 optical fiber (SONET STS-48) optical transceiver module for SONET connection to the network.

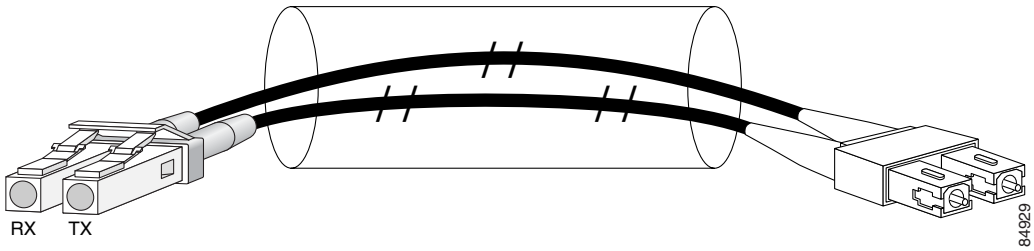
The 1-Port OC-48/STM-16 POS SPA supports the following type of optical transceiver module:

- Single-mode short reach (SR) SFP module—SFP-OC48-SROC-48/STM-16c
- Single-mode intermediate reach (IR) SFP module—SFP-OC48-IR1OC-48/STM-16c
- Single-mode long reach (LR) SFP module—SFP-OC48-LR2OC-48/STM-16c

Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns (nominal diameter is approximately 10/125 microns) to connect your router to a network.

Figure 2-42 shows the cable type for use with the XFP optical transceiver module on the 1-Port OC-48/STM-16 POS SPA.

Figure 2-42 LC-Type Cable for the SFP Optical Transceiver Modules



Note The 40-pin connector on the 1-Port OC-48/STM-16 POS SPA is used for resilient packet ring (RPR) connections.

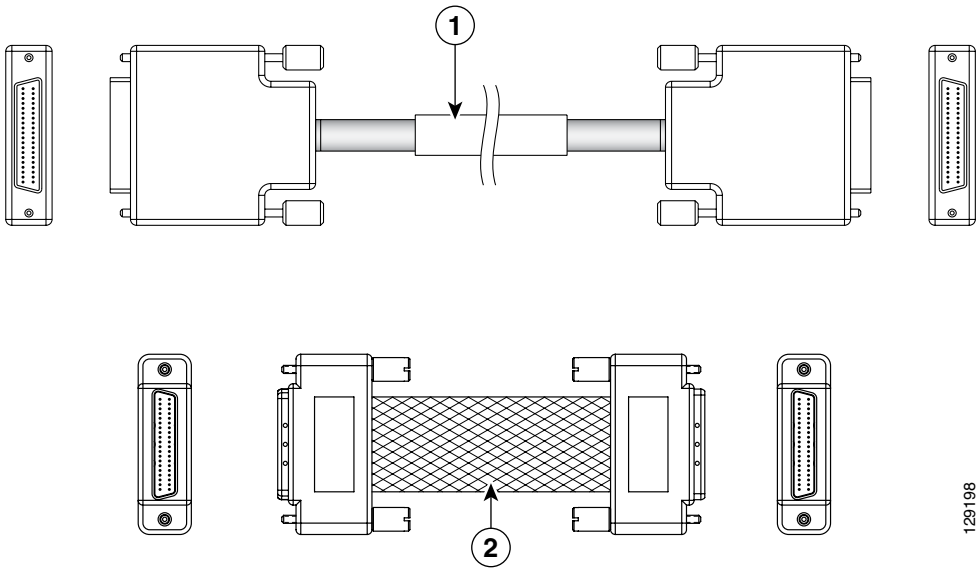
Mate Interface Cables

The 1-Port OC-48/STM-16 POS SPA supports two mate interface configurations:

- Mate between two OC-48 SPAs in the same SIP
- Mate between two OC-48 SPAs in adjacent SIPs

Two 1-Port OC-48/STM-16 POS SPAs are connected using a 40–pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-43 shows the mate cables used to connect the SPAs.

Figure 2-43 SPA Mate Cables



1	Long length RPR mate cable for single port RPR SPAs (CBL-RPR-OC48-L)	2	Short length RPR mate cable for single port RPR SPAs (CAB-RPR-OC48-S)

Note The RPR mate cable is necessary only when the SPA is to be used in RPR mode. It is not needed in POS mode. Support for the RPR feature is dependent on the platform software release feature content. Verify support for the RPR feature support by reviewing the relevant SPA datasheets or by contacting your Cisco representative.

2-Port and 4-Port OC-48/STM-16 POS SPA Overview

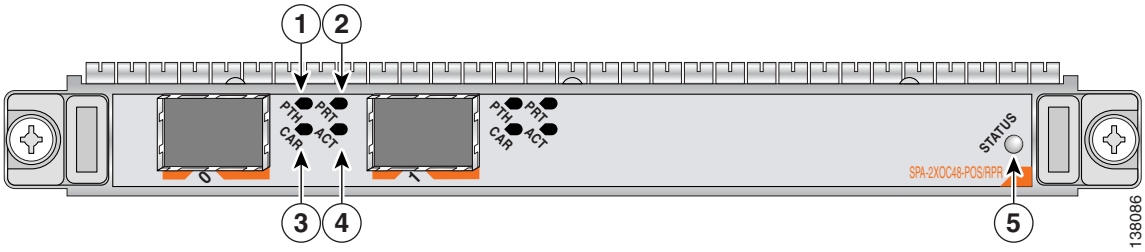
The following sections describe the 2-Port and 4-Port OC-48/STM-16 POS SPA:

- 2-Port and 4-Port OC-48/STM-16 POS SPA LEDs, page 2-61
- 2-Port and 4-Port OC-48/STM-16 POS SPA Interface Specifications, page 2-62
- 2-Port and 4-Port OC-48/STM-16 POS SPA Cables, Optical Transceiver Modules, and Connectors, page 2-62

2-Port and 4-Port OC-48/STM-16 POS SPA LEDs

The 2-Port and 4-Port OC-48/STM-16 POS SPA has five types of LEDs: four LEDs for each port on the SPA and one STATUS LED, as shown in Figure 2-44.

Figure 2-44 2-Port OC-48 POS/RPR SPA Faceplate



1	PTH (Pass Through) LED	**4**	ACT (Active Loopback) LED
2	PRT (Protect) LED	**5**	STATUS LED
3	CAR (Carrier Alarm) LED		

Table 2-40 describes the 2-Port and 4-Port OC-48/STM-16 POS SPA LEDs.

Table 2-40 2-Port and 4-Port OC-48/STM-16 POS SPA LEDs

LED Label	Color	State	Meaning
PTH	Off	Off	Port is not in pass-through mode.
	Amber	On	Port is in pass-through mode.
CAR	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
	Amber	Flashing	Port is enabled by software, and there is a side mismatch.
PRT	Off	Off	Port is not wrapped or steering.
	Green	On	A node on the ring is wrapped.
	Green	Flashing	A node on the ring is steering.
	Amber	On	Port is locally wrapped.
	Amber	Flashing	Port is locally steering.
ACT	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.

Table 2-40 2-Port and 4-Port OC-48/STM-16 POS SPA LEDs (continued)

LED Label	Color	State	Meaning
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and the SPA is being configured.

2-Port and 4-Port OC-48/STM-16 POS SPA Interface Specifications

The physical layer interface for the 2-Port and 4-Port OC-48/STM-16 POS SPA is Optical Carrier-48 (OC-48), and provides SONET and SDH network connectivity with a per-port bandwidth of 2.488 Gbps.

Each port on the 2-Port and 4-Port OC-48/STM-16 POS SPA has one duplex LC-type receptacle that allows connection to single-mode optical fiber.

2-Port and 4-Port OC-48/STM-16 POS SPA Cables, Optical Transceiver Modules, and Connectors

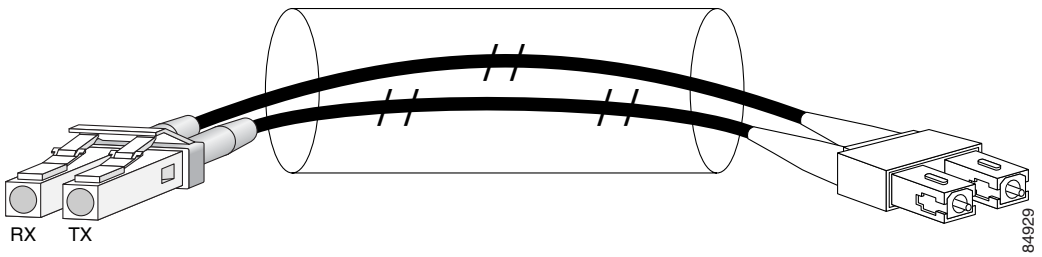
Use single-mode (for intermediate-reach configurations) optical fiber cable to connect your router to a network or to connect two OC-48-equipped routers back-to-back.

The 2-Port and 4-Port OC-48/STM-16 POS SPA supports the following types of optical transceiver modules:

- Single-mode short-reach (SR) SFP module—SFP-OC48-SR OC48/STM16c
- Single-mode intermediate-reach (IR) SFP module—SFP-OC48-IR1 OC48/STM16c
- Single-mode long-reach (LR) SFP module—SFP-OC48-LR2 OC48/STM16c

Each port on the 2-Port and 4-Port OC-48/STM-16 POS SPA has one duplex LC-type receptacle. For single-mode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-45) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Figure 2-45 LC-Type Cable



OC-48 Module Connections

Table 2-41 shows the OC-48 specifications for use with the 2-Port and 4-Port OC-48/STM-16 POS SPA.

Table 2-41 OC-48 Specifications

Specification	Description
Wavelength	OC-48 SR: 1266 nm to 1360 nm OC-48 IR-1: 1260 nm to 1360 nm OC-48 LR-2: 1500 nm to 1580 nm
Cabling distance (maximum)	OC-48 SR: 2 km (1.2 miles) OC-48 IR-1: 15 km (9.3 miles) OC-48 LR-2: 80 km (49.7 miles)
Operating case temperature range	OC-48 SR: 23 to 158 degrees F (–5 to 70 degrees C) OC-48 IR-1: 23 to 158 degrees F (–5 to 70 degrees C) OC-48 LR-2: 23 to 158 degrees F (–5 to 70 degrees C)
TX power	OC-48 SR: –10 to –3 dBm OC-48 IR-1: –5 to 0 dBm OC-48 LR-2: –2 to +3 dBm
Receiver sensitivity (maximum)	OC-48 SR: –18 dBm OC-48 IR-1: –18 dBm OC-48 LR-2: –28 dBm
RX overload	OC-48 SR: –3 dBm OC-48 IR-1: 0 dBm OC-48 LR-2: –9 dBm
Maximum receiver power damage	OC-48 SR: +5 dBm OC-48 IR-1: +5 dBm OC-48 LR-2: +5 dBm

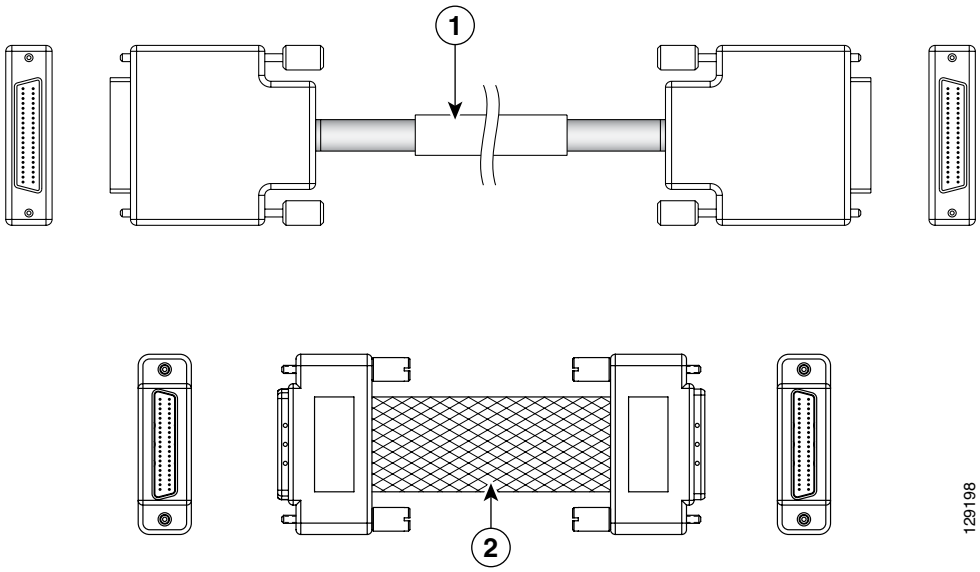
Mate Interface Cables

The 2-Port and 4-Port OC-48/STM-16 POS SPA supports two mate interface configurations:

- Mate between two OC-192 SPAs in the same SIP
- Mate between two OC-192 SPAs in adjacent SIPs

Two SPAs are connected using a 40–pin connector copper mate cable. The length of the cables allow only two possible connection scenarios, next slot horizontal and same slot vertical. This assumes that the chassis is mounted vertically. Figure 2-46 shows the mate cables used to connect the SPAs.

Figure 2-46 SPA Mate Cables



1	Long length RPR mate cable for single port RPR SPAs (CBL-RPR-OC192-L)	2	Short length RPR mate cable for single port RPR SPAs (CAB-RPR-OC192-S)

2-Port OC-48 POS RPR SPA Overview

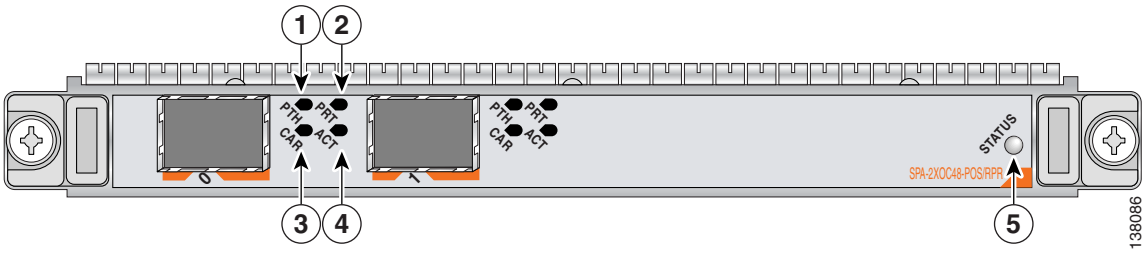
The following sections describe the 2-Port OC48-POS/RPR SPA:

- 2-Port OC48-POS/RPR SPA LEDs, page 2-64
- 2-Port OC48-POS/RPR SPA Interface Specifications, page 2-66
- 2-Port OC48-POS/RPR SPA Cables, Optical Transceiver Modules, and Connectors, page 2-66

2-Port OC48-POS/RPR SPA LEDs

The 2-Port OC48-POS/RPR SPA has five LEDs, as shown in Figure 2-47.

Figure 2-47 2-Port OC48-POS/RPR SPA Faceplate



1	PTH (Pass-Through) LED	**4**	ACT (Active Loopback) LED
2	PRT (Protect) LED	**5**	STATUS LED
3	CAR (Carrier/Alarm) LED		

The 2-Port OC48-POS/RPR SPA LEDs are described in Table 2-42.

Table 2-42 2-Port OC48-POS/RPR SPA LEDs

LED Label	Color	State	Meaning
PTH	Off	Off	Port is not in pass-through mode.
	Amber	On	Port is in pass-through mode.
CAR	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
	Amber	Blinking	Port is enabled by software, and there is a side mismatch.
PRT	Off	Off	Port is not in wrap mode or steer.
	Green	On	A node on the ring is wrapped.
	Green	Blinking	A node on the ring is steering pass-through
	Amber	On	Port is locally wrapped
	Amber	Blinking	Port is locally steering
ACT	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Green	On	SPA is ready and operational.
	Amber	On	SPA power is on and good, and SPA is being configured.

2-Port OC48-POS/RPR SPA Interface Specifications

The physical layer interface for the 2-Port OC48-POS/RPR SPA is Optical Carrier-48 (OC-48), and the 2-Port OC48-POS/RPR SPA is designed to comply with POS specifications. The 2-Port OC48-POS/RPR SPA provides two 2.488-Gbps network interfaces for all supported platforms.

2-Port OC48-POS/RPR SPA Cables, Optical Transceiver Modules, and Connectors

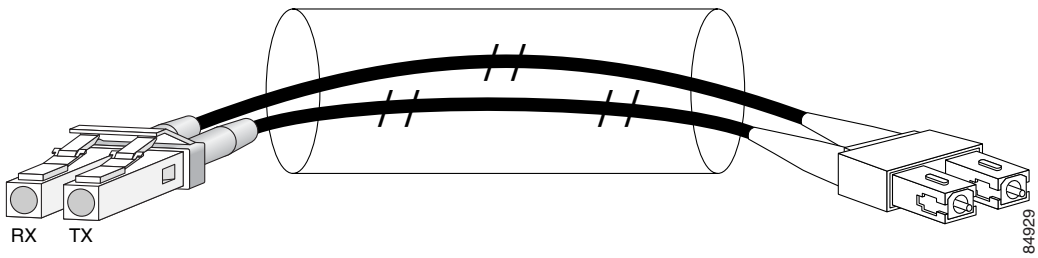
Use single-mode (for intermediate-configurations) optical fiber cable to connect your router to a network or to connect two OC-48-equipped routers back-to-back.

The 2-Port OC48-POS/RPR SPA supports the following types of optical transceiver modules:

- Single-mode short-reach (SR) SFP module—SFP-OC48-SR
- Single-mode intermediate-reach (IR) SFP module —SFP-OC48-IR1
- Single-mode long-reach (LR) SFP module — SFP-OC48-LR2

Each port on the 2-Port OC48-POS/RPR SPA has one duplex LC-type receptacle. For single-mode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-48) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Figure 2-48 Duplex Patch Cable with LC-Type Connectors



Cisco XR 12000 IPSec VPN SPA Overview

The Cisco XR 12000 IPSec VPN SPA (SPA) provides remote access and remote site VPN connectivity for the Cisco XR 12000 series router.

The following features are supported:

- Site-to-Site communication over point-to-point IPSec/GRE tunnels
- Remote User Access over IPSec tunnels.

Any slot of the Cisco XR 12000 series router that contains a Cisco XR 12000 SIP-401, Cisco XR 12000 SIP-501, or a Cisco XR 12000 SIP-601 can support up to two Cisco XR 12000 IPSec VPN SPAs, or any mixture of the Cisco XR 12000 IPSec VPN SPA with other interface SPA types on the same SIP card.

Note that the Cisco XR 12000 IPSec VPN SPA (SPA-IPSEC-2G-2) supported on the Cisco XR 12000 series router is a different form factor from the IPSec VPN SPA supported on the Cisco 7600 router (SPA-IPSEC-2G-1).

Warning **Attempting to install a SPA-IPSEC-2G-1 into a Cisco XR 12000 SIP-401, Cisco XR 12000 SIP-501, or a Cisco XR 12000 SIP-601 will result in mounting rail damage. Only the Cisco XR 12000 IPSec VPN SPA (SPA-IPSEC-2G-2) is supported on the Cisco XR 12000 series router.**

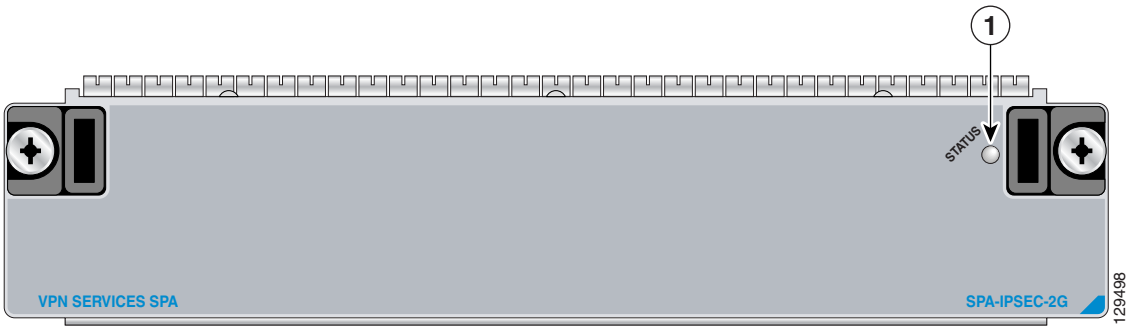
The following sections describe the Cisco XR 12000 IPSec VPN SPA:

- Cisco XR 12000 IPSec VPN SPA LEDs, page 2-67

Cisco XR 12000 IPSec VPN SPA LEDs

The Cisco XR 12000 IPSec VPN SPA has one LED, as shown in Figure 2-49.

Figure 2-49 Cisco XR 12000 IPSec VPN SPA Faceplate



1	STATUS LED		

The Cisco XR 12000 IPSec VPN SPA LED is described in Table 2-43.

Table 2-43 Cisco XR 12000 IPSec VPN SPA LED

LED Label	Color	State	Meaning
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA is on and good, and the SPA is being configured.
	Green	On	SPA is ready and operational.

1-Port and 3-Port Clear Channel OC-3 ATM SPA Overview

The 1-Port and 3-Port Clear Channel OC-3 ATM SPA is a single-height SPA that installs into one SIP subslot. The Clear Channel OC-3 ATM SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity with a per-port bandwidth of 155.52 Mbps. For more information about SPA bandwidth, see the "Bandwidth Oversubscription" section in this chapter.

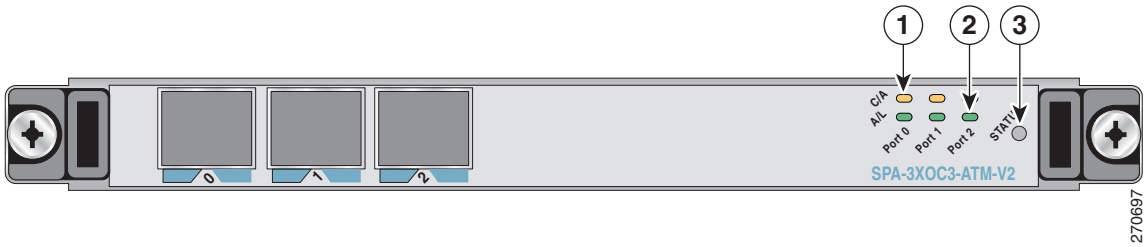
The following sections describe the 1-Port and 3-Port Clear Channel OC-3 ATM SPA:

- 1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs, page 2-68
- 1-Port and 3-Port Clear Channel OC-3 ATM SPA Interface Specifications, page 2-69
- 1-Port and 3-Port Clear Channel OC-3 ATM SPA Cables and Connectors, page 2-69

1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs

The 1-Port and 3-Port Clear Channel OC-3 ATM SPA has three types of LEDs. There are two LEDs for each port on the SPA, and one STATUS LED. Figure 2-50 shows an example of these LEDs on a 1-Port and 3-Port Clear Channel OC-3 ATM SPA.

Figure 2-50 1-Port and 3-Port Clear Channel OC-3 ATM SPA Faceplate



1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs are described in Table 2-44.

Table 2-44 1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.
STATUS	Off	Off	SPA power is off.

Table 2-44 1-Port and 3-Port Clear Channel OC-3 ATM SPA LEDs (continued)

LED Label	Color	State	Meaning
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

1-Port and 3-Port Clear Channel OC-3 ATM SPA Interface Specifications

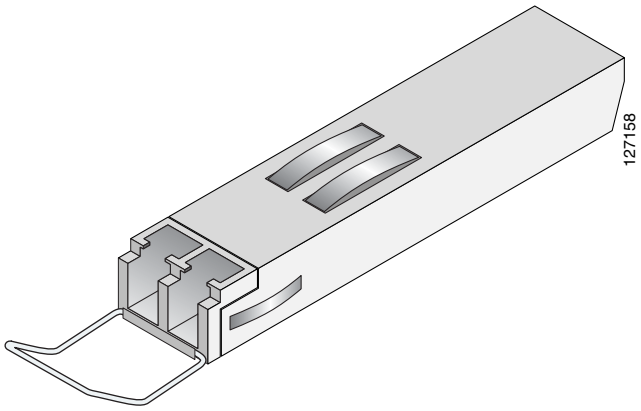
The physical layer interface for the 1-Port and 3-Port Clear Channel OC-3 ATM SPA is Optical Carrier-3 (OC-3), and the data link layer is designed to comply with ATM specifications. The 1-Port and 3-Port Clear Channel OC-3 ATM SPA provides up to four 155-Mbps OC-3 network interfaces for all supported platforms.

Each SPA port accepts an SFP module with a duplex LC-type receptacle that allows connection to single-mode or multimode optical fiber.

1-Port and 3-Port Clear Channel OC-3 ATM SPA Cables and Connectors

The 1-Port and 3-Port Clear Channel OC-3 ATM SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see Figure 2-51).

Figure 2-51 SFP Optics Module



The SFP optical transceiver modules used with the 1-Port and 3-Port Clear Channel OC-3 ATM SPA provide the following optical fiber options:

- Multimode—155-Mbps, OC-3 optical fiber (SONET STS-3c or SDH STM-1)

  Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.

- Single-mode—155-Mbps, OC-3 optical fiber (SONET STS-3c or SDH STM-1)

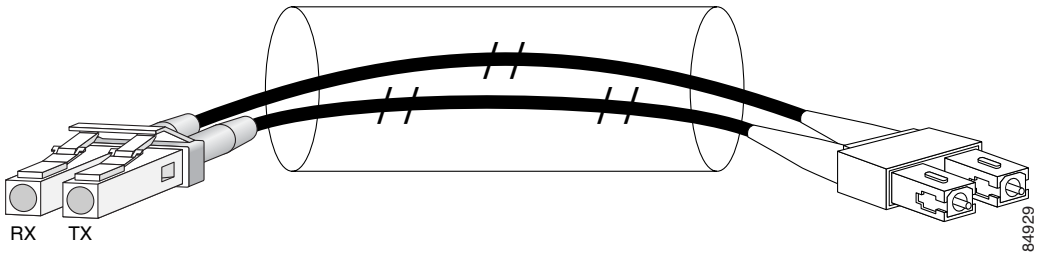
  Use a single-mode optical fiber that has a modal-field diameter of 8.7 ± 0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-52) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Use a single-mode (for intermediate-reach or long-reach configurations) or multimode optical fiber cable to connect your router to a network or to connect two OC-3-equipped routers back-to-back.

Long-range SFP optical transceiver modules (for long-reach configurations) cannot be connected back-to-back without using an attenuator between them.

Figure 2-52 Duplex Patch Cable with LC-Type Connectors



1-Port Clear Channel OC-12 ATM SPA Overview

The 1-Port Clear Channel OC-12 ATM SPA is a single-height ATM SPA that can be installed into one SIP subslot. The OC-12 ATM SPA with small form-factor pluggable (SFP) optical transceiver modules provides SONET and SDH network connectivity with a per-port bandwidth of 622.08 Mbps. For more information about SPA bandwidth, see the "Bandwidth Oversubscription" section in this chapter.

The following sections describe the 1-Port Clear Channel OC-12 ATM SPA:

- 1-Port Clear Channel OC-12 ATM SPA LEDs, page 2-70
- 1-Port Clear Channel OC-12 ATM SPA Interface Specifications, page 2-71
- 1-Port Clear Channel OC-12 ATM SPA Cables and Connectors, page 2-72

1-Port Clear Channel OC-12 ATM SPA LEDs

The 1-Port Clear Channel OC-12 ATM SPA has three types of LEDs. There are two LEDs for the port on the SPA, and one STATUS LED, as shown in Figure 2-53.

Figure 2-53 1-Port Clear Channel OC-12 ATM SPA Faceplate

1	C/A (Carrier/Alarm) LED	**3**	STATUS LED
2	A/L (Active Loopback) LED		

The 1-Port Clear Channel OC-12 ATM SPA LEDs are described in Table 2-45.

Table 2-45 1-Port Clear Channel OC-12 ATM SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and there is a valid SONET signal without any alarms.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, and loopback is off.
	Amber	On	Port is enabled by software, and loopback is on.
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

1-Port Clear Channel OC-12 ATM SPA Interface Specifications

The physical layer interface for the 1-Port Clear Channel OC-12 ATM SPA is Optical Carrier-12 (OC-12), and the 1-Port Clear Channel OC-12 ATM SPA is designed to comply with ATM specifications. The 1-Port Clear Channel OC-12 ATM SPA provides one 622.08 Mbps OC-12 network interface for all supported platforms.

The single SPA port accepts an SFP module with a duplex LC-type receptacle that allows connection to single-mode or multimode optical fiber.

1-Port Clear Channel OC-12 ATM SPA Cables and Connectors

The 1-Port Clear Channel OC-12 ATM SPA uses a small form-factor pluggable (SFP) optical transceiver module installed in each port for SONET and SDH single-mode and multimode optical fiber connection (see Figure 2-54).

The 1-Port Clear Channel OC-12 ATM SPA supports the following types of optical transceiver modules:

Multimode (MM) SFP module—SFP-OC12-MM

Short-reach (SR) SFP module—SFP-OC12-SR

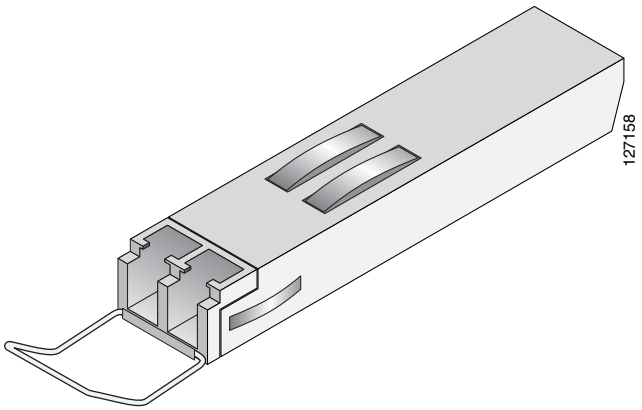
Intermediate-reach (IR) SFP module (15 km)—SFP-OC12-IR1

Long-reach (LR) SFP module (40 km)—SFP-OC12-LR1

Long-reach (LR) SFP module (80 km)—SFP-OC12-LR2

The SR, IR, and LR1 transceivers provide a full-duplex 622.08-Mbps, laser-based SONET/SDH-compliant interface with an average wavelength of 1310 nm. The LR2 transceivers provide a full-duplex, 622.08-Mbps, laser-based SONET/SDH-compliant interface with an average wavelength of 1530 nm. The multimode transceiver provides a full-duplex, 622.08-Mbps, LED-based SONET/SDH-compliant interface with an average wavelength of 1325 nm.

Figure 2-54 SFP Optics Module



The 1-Port Clear Channel OC-12 ATM SPA provides the following optical fiber options:

- Multimode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)

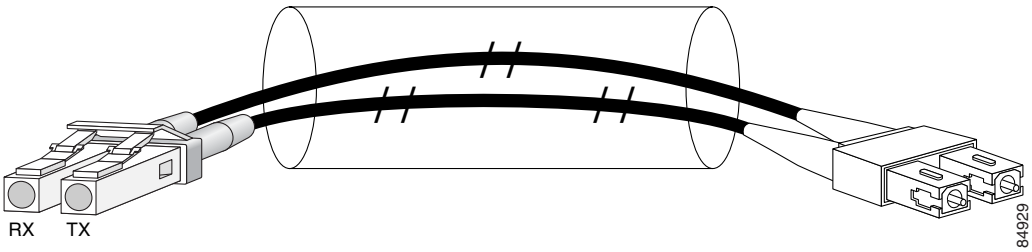
  Use a multimode optical fiber that has a core/cladding diameter of 62.5/125 microns.

- Single-mode—622.08-Mbps, OC-12 optical fiber (SONET STS-12c or SDH STM-4)

  Use a single-mode optical fiber that has a modal-field diameter of 8.7 ±0.5 microns. (Nominal diameter is approximately 10/125 microns.)

For single-mode and multimode optical fiber connections, you can use either a duplex LC-type cable (see Figure 2-55) or two simplex LC-type cables, one for transmit (TX) and one for receive (RX).

Figure 2-55 Duplex Patch Cable with LC-Type Connectors



2-Port Channelized T3/E3 ATM CEoP SPA Overview

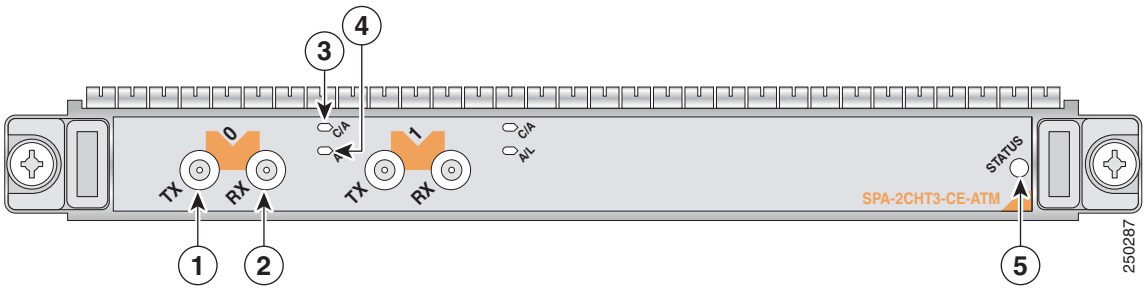
The following sections describe the 2-Port Channelized T3/E3 ATM CEoP SPA:

- 2-Port Channelized T3/E3 ATM CEoP SPA LEDs
- 2-Port Channelized T3/E3 ATM CEoP SPA Interface Specifications
- 2-Port Channelized T3/E3 ATM CEoP SPA Cables and Connectors

2-Port Channelized T3/E3 ATM CEoP SPA LEDs

The 2-Port Channelized T3/E3 ATM CEoP SPA has three types of LEDs (see Figure 2-56). There are two LEDs for each port on the SPA, and a single STATUS LED for the SPA.

Figure 2-56 2-Port Channelized T3/E3 ATM CEoP SPA Faceplate



1	TX (Transmit) connector	4	A/L (Active/Loopback)
2	RX (Receive) connector	5	STATUS LED
3	C/A (Carrier/Alarm) LED		

The 2-Port Channelized T3/E3 ATM CEoP SPA LEDs are described in Table 2-46.

Table 2-46 2-Port Channelized T3/E3 ATM CEoP SPA LEDs

LED Label	Color	State	Meaning
C/A	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software.
	Amber	On	Port is enabled by software, and there is at least one alarm.
A/L	Off	Off	Port is not enabled by software.
	Green	On	Port is enabled by software, loopback is off.
	Amber	On	Port is enabled by software, loopback is on.
STATUS	Off	Off	SPA power is off.
	Amber	On	SPA power is on and good, and SPA is being configured.
	Green	On	SPA is ready and operational.

2-Port Channelized T3/E3 ATM CEoP SPA Interface Specifications

The framer processes incoming and outgoing T3 (cbit, m13/m23, and unframe) and E3 (g751, g832, and unframe) frames. The framer operates at T3 or E3 line rates (44.736 or 34.368 Mbps), depending on the mode in which it is configured.

Note For Cisco IOS XR Software Release 3.7.0, the 2-Port Channelized T3/E3 ATM CEoP SPA supports T3 ATM only. E3 ATM is not supported.

T3/E3 data is encapsulated and sent across the MPLS network over user-configurable pseudowires. In ATM mode, data is encapsulated into ATM cells and transported across the network.

In circuit emulation (CE) mode, channelized data is encapsulated in structured mode using the Circuit Emulation Services over Packet Switched Network (CESoPSN) format, and unchannelized data is encapsulated in unstructured mode using Structure-Agnostic TDM over Packet (SAToP) format. The encapsulation adds transport overhead to the CEM frames or ATM cells before transport and removes the overhead at the far end.

Note For Cisco IOS XR Software Release 3.7.0, the 2-Port Channelized T3/E3 ATM CEoP SPA does not support circuit emulation (CE) mode.

The T3/E3 SPA interface is compliant with ANSI and Telco standards. The interface also provides support for Management Information Base (MIB) RFC 2495, RFC 2496, and T1.231.

2-Port Channelized T3/E3 ATM CEoP SPA Cables and Connectors

The interface connectors on the 2-Port Channelized T3/E3 ATM CEoP SPA are 75-ohm coaxial Siemax types, with one connector and cable for transmit (TX) and one for receive (RX).

The following cables can be used with the 2-Port Channelized T3/E3 ATM CEoP SPA. The cables have BNC connectors on one end and the Siemax connectors on the other. If similar SPAs are connected back-to-back, both ends of the cable are Siemax.

- CAB-T3E3-RF-BNC-M (T3 or E3 Cable, 1.0/2.3 RF to BNC-Male, 10 feet)
- CAB-T3E3-RF-BNC-F (T3 or E3 Cable, 1.0/2.3 RF to BNC-Female, 10 feet)
- CAB-T3E3-RF-OPEN (T3 or E3 Cable, 1.0/2.3 RF to BNC-Open end, 10 feet)

Note

- The Cisco cable part numbers are 72-4124-01 (with male BNC end) and 72-4131-01 (with female BNC end).
- The SPA can receive data over the cable up to a maximum distance of 1350 ft (411.5 meters).

Figure 2-56 shows the connectors on the 2-Port Channelized T3/E3 ATM CEoP SPA, and Table 2-47 describes the signal descriptions for these connectors.

Table 2-47 2-Port Channelized T3/E3 ATM CEoP SPA Connectors

Connector Label	Meaning
TX	Transmitted signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the TX Siemax connector.
RX	Received signals appear on the center contact, and the outer shield is ground for the 75-ohm RG-59 coaxial cable you attach to the RX Siemax connector.

CHAPTER 3

Preparing to Install a Shared Port Adapter or a SPA Interface Processor

Revised: June 2008, OL-9175-05

This chapter describes the general equipment, safety, and site preparation requirements for installing SIPs and SPAs. This chapter contains the following sections:

- Safety Guidelines, page 3-1
- Preventing Electrostatic Discharge, page 3-3
- Required Tools and Equipment, page 3-4

Safety Guidelines

Before you perform any procedure in this publication, review the safety guidelines in this section to avoid injuring yourself or damaging the equipment.

The following guidelines are for your safety and to protect equipment. The guidelines do not include all hazards. Be alert.

- Safety Warnings, page 3-1
- Electromagnetic Compatibility Regulatory Statements, page 3-2
- Electrical Equipment Guidelines, page 3-2
- Telephone Wiring Guidelines, page 3-2
- Laser/LED Safety, page 3-2

Safety Warnings

Note Review the safety warnings listed in the *Regulatory Compliance and Safety Information for Cisco XR 12000 Series Internet Router* publication (Document Number 78-4347-xx) that accompanied your router before installing, configuring, or maintaining a line card.

- Keep the work area clear and dust free during and after installation. Do not allow dirt or debris to enter into any laser-based components.

- Do not wear loose clothing, jewelry, or other items that could get caught in the router while working with line cards.
- Cisco equipment operates safely when it is used in accordance with its specifications and product usage instructions.

Electromagnetic Compatibility Regulatory Statements

Electromagnetic compatibility regulatory statements are listed in the *Regulatory Compliance and Safety Information for XR Cisco 12000 Series Internet Router* publication (Document Number 78-4347-xx) that accompanied your router. Review these before installing, configuring, or maintaining your SIP or SPA.

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe; carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Telephone Wiring Guidelines

Use the following guidelines when working with any equipment that is connected to telephone wiring or to other network cabling:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Laser/LED Safety

The single-mode transmitter in the module uses a small laser to transmit the light signal to the network ring. Keep the transmit port covered whenever a cable is not connected to it. Although multimode transceivers typically use LEDs for transmission, it is good practice to keep open ports covered and avoid staring into open ports or apertures. The single-mode aperture port contains a laser warning label, as shown in Figure 3-1.

Figure 3-1 Laser Warning Labels for Single-Mode Port

Warning **Invisible laser radiation may be emitted from the aperture ports of the single-mode products when no fiber cable is connected. *Avoid exposure and do not stare into open apertures.***

Warning **Class 1 laser product.**

The multimode aperture contains a Class 1 LED warning label, as shown in Figure 3-2.

Figure 3-2 Class 1 LED Warning Label for Multimode Port

Warning **Because invisible laser radiation may be emitted form the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.**

Warning **Class 1 LED product.**

Preventing Electrostatic Discharge

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. Electromagnetic interference (EMI) shielding is an integral component of the line card. Cisco recommends using an ESD-preventive strap whenever you are handling network equipment or one of its components.

The following are guidelines for preventing ESD damage:

- Always use an ESD-preventive wrist or ankle strap and ensure that it makes good skin contact. Connect the equipment end of the connection cord to an ESD connection socket on the router or to bare metal on the chassis.
- Handle SIPs by the captive installation screws, the provided handle, ejector levers, or the line card metal carrier only; avoid touching the board or connector pins.
- Place removed SIPs board-side-up on an antistatic surface or in a static shielding bag. If you plan to return the component to the factory, immediately place it in a static shielding bag.
- Avoid contact between the SIPs and clothing. The wrist strap only protects the board from ESD voltages on the body; ESD voltages on clothing can still cause damage.

Warning **For safety, periodically check the resistance value of the ESD strap. The measurement should be between 1 and 10 megohms.**

Required Tools and Equipment

You need the following tools and parts to remove and install SIPs:

- Flat-blade or Phillips screwdriver
- ESD-preventive wrist or ankle strap and instructions
- Interface cables to connect the SIP with another router or switch

CHAPTER 4

Installing and Removing a SPA Interface Processor

Revised: June 2008, OL-9175-05

This chapter describes how to install or remove SIPs on the Cisco XR 12000 series router. This chapter contains the following sections:

- Handling SIPs, page 4-1
- Removing and Installing a SIP, page 4-2

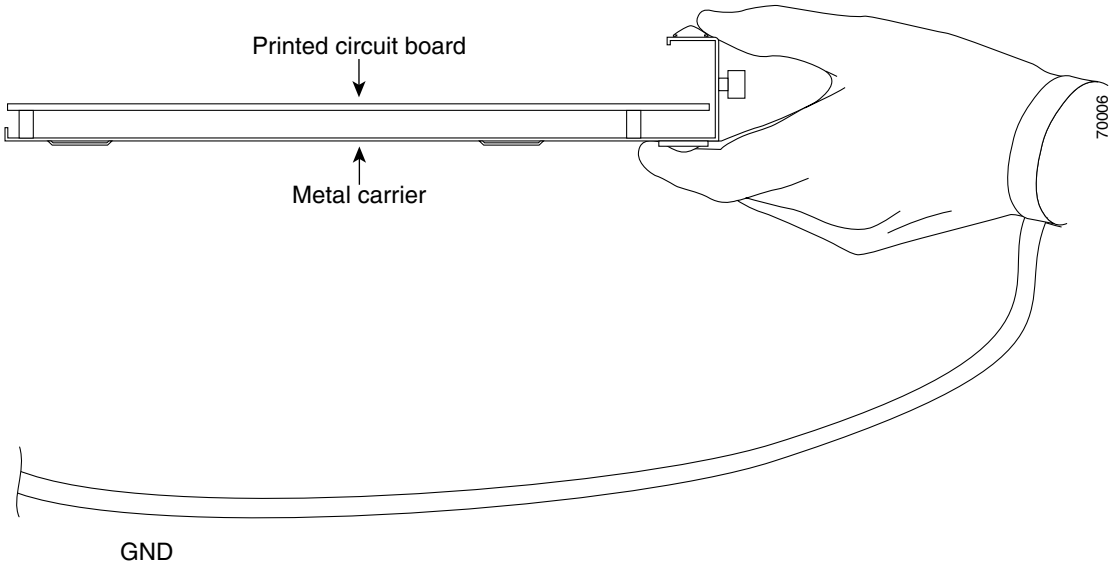
Handling SIPs

Each SIP circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage. Before you begin installation, read "Preparing to Install a Shared Port Adapter or a SPA Interface Processor" for a list of parts and tools required for installation.

Caution Always handle the SIP by the carrier edges and handle; never touch the SIP components or connector pins. (See Figure 4-1.)

When a slot is not in use, a blank must fill the empty slot to allow the router to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the installed modules. If you plan to install an SIP in a slot that is not in use, you must first remove the blank.

Figure 4-1 Handling a SIP



Removing and Installing a SIP

The following sections describe the procedures for removing and installing SIPs:

- Guidelines for SIP Removal and Installation
- Removing a SIP
- Installing a SIP

Note Some of the procedures in the following sections use illustrations of a Cisco 12012 Router to support the descriptions of removing and installing SIPs. Although the card cages of Cisco XR 12000 series routers differ, the designated use of slots and the process of installing and removing a SIP are basically the same. Therefore, separate procedures and illustrations are not included in this publication.

Guidelines for SIP Removal and Installation

Guidelines for SIP removal and installation include the following:

- Online insertion and removal (OIR) is supported, enabling you to remove and install SIPs while the router is operating. OIR is seamless to users on the network, maintains all routing information, and ensures session preservation.

Note With OIR, notifying the software or resetting the power is not required. However, you have the option of using the **shutdown** command before removing a SIP.

- After you reinstall a SIP, the router automatically downloads the necessary software from the route processor (RP). Next, the router brings online only those interfaces that match the current configuration and were previously configured as *administratively up*. You must configure all others with the **configure** command.

Caution The router may indicate a hardware failure if you do not follow proper procedures. Remove or insert only one SIP at a time. Allow at least 15 seconds for the router to complete the preceding tasks before removing or inserting another SIP.

- SIPs have two ejector levers to release the card from its backplane connector. Use the levers when you are removing the SIP and to seat the SIP firmly in its backplane connector when you are installing the SIP. The ejector levers align and seat the card connectors in the backplane.

Caution When you remove a SIP, always use the ejector levers to ensure that the connector pins disconnect from the backplane in the logical sequence expected by the router. Any card that is only partially connected to the backplane can halt the router.

When you install a SIP, always use the ejector levers to ensure that the card is correctly aligned with the backplane connector; the connector pins should make contact with the backplane in the correct order, indicating that the card is fully seated in the backplane. A card that is only partially seated in the backplane will cause the router to hang and subsequently crash.

Removing a SIP

If you are replacing a failed SIP, remove the existing SIP first, then install the new SIP in the same slot. To remove a SIP, use Figure 4-2 as a reference and follow these steps:

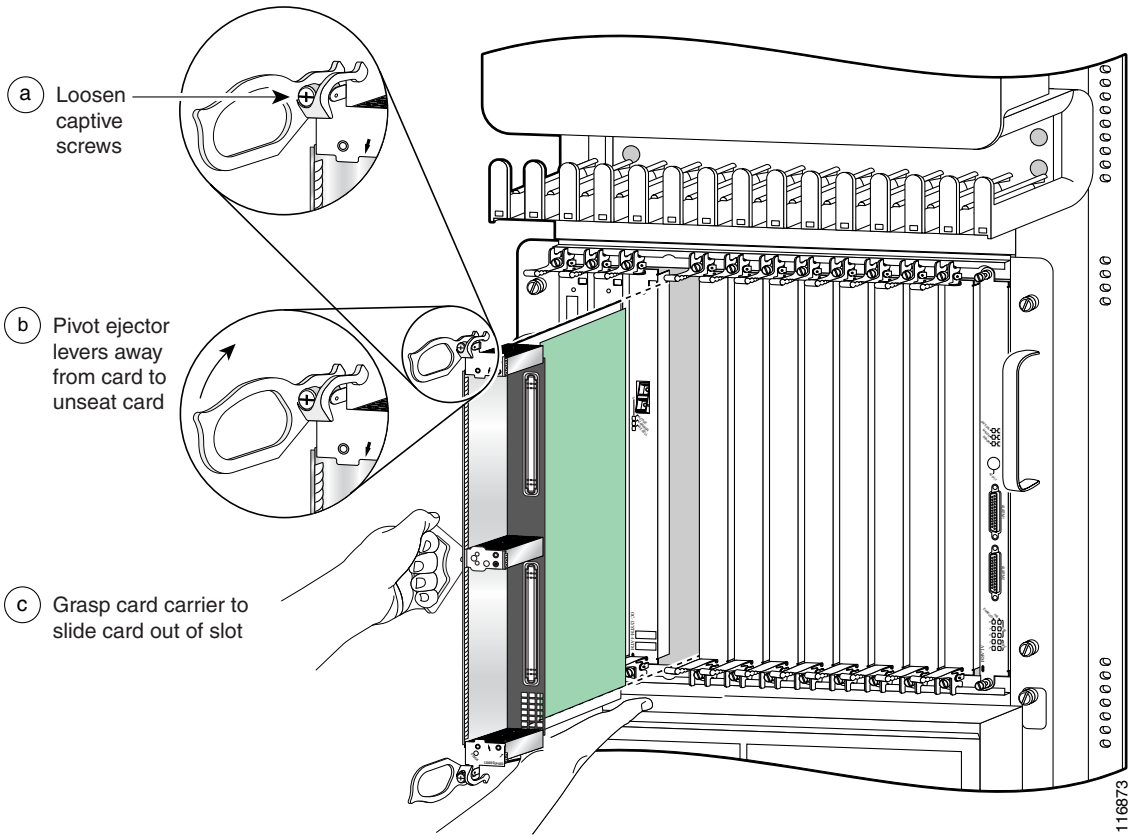
Step 1 Attach an ESD-preventive wrist strap and follow its instructions for use.

Step 2 Disconnect and remove all interface cables from the ports; note the current connections of the cables to the ports on the SIP.

Step 3 Detach the SIP cable-management bracket from the SIP.

Step 4 Use a screwdriver to loosen the captive screw at each end of the SIP faceplate. (See Figure 4-2.)

Figure 4-2 SIP Removal and Installation



Caution When you remove a SIP, always use the ejector levers to ensure that the SIP connector pins disconnect from the backplane in the logical sequence expected by the router. Any SIP that is only partially connected to the backplane can halt the router.

Step 5 Simultaneously pivot the ejector levers away from each other to release the SIP from the backplane connector. (See Figure 4-2.)

Step 6 Grasp the ejector levers and pull the SIP halfway out of the slot.

Step 7 Grasp the SIP by the handle and gently pull it straight out of the slot, keeping your other hand under the SIP to guide it. (See Figure 4-2.) Avoid touching the SIP printed circuit board, components, or any connector pins.

Step 8 Place the removed SIP on an antistatic mat, or immediately place it in an antistatic bag if you plan to return it to the factory.

Step 9 If the SIP slot is to remain empty, install a line card blank (Product Number MAS-GSR-BLANK) to keep dust out of the chassis and to maintain proper airflow through the SIP compartment. Secure the SIP blank to the chassis by tightening its captive screws.

Installing a SIP

A SIP slides into almost any available SIP slot and connects directly to the backplane. If you install a new SIP, you must first remove the SIP blank from the available slot.

Note Refer to the installation and configuration guide for your router for information on SIP slot types, slot width, and slot location.

Caution The router may indicate a hardware failure if you do not follow proper procedures. Remove or insert only one SIP at a time. Allow at least 15 seconds for the router to complete the preceding tasks before removing or inserting another SIP.

To install a SIP, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

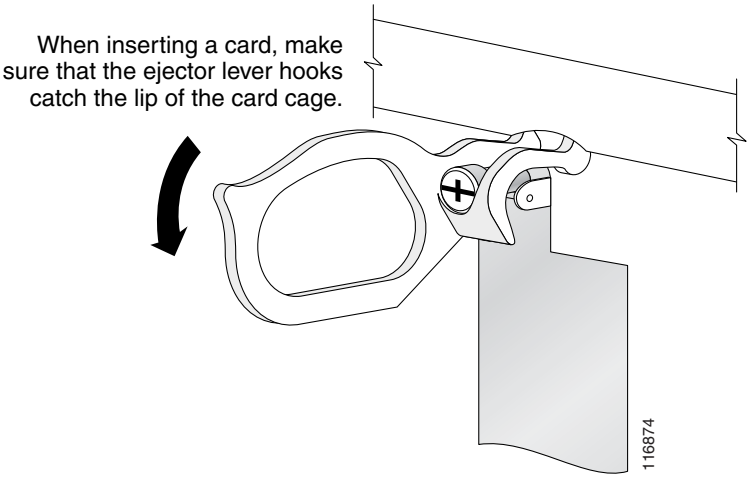
Step 2 Choose an available SIP slot for the SIP, and verify that the SIP interface cable is long enough for you to connect the SIP with any external equipment.

Caution To prevent ESD damage, handle SIPs by the captive installation screws, the provided handle, ejector levers, or the card carrier edges only. Do not touch any of the electrical components or circuitry.

Step 3 Grasp the handle of the SIP with one hand and place your other hand under the card carrier to support the weight of the card; position the card for insertion into the card cage slot. Avoid touching the SIP printed circuit board, components, or any connector pins.

Step 4 Carefully slide the SIP into the slot until the ejector levers make contact with the edges of the card cage, then *stop* when the ejector lever hooks catch the lip of the card cage. If they do not catch, try reinserting the SIP until the ejector lever hooks are fully latched. (See Figure 4-3.)

Figure 4-3 Ejector Levers



Caution When you install a SIP, always use the ejector levers to ensure that the card is correctly aligned with the backplane connector, the card connector pins make contact with the backplane in the correct order, and the card is fully seated in the backplane. A card that is only partially seated in the backplane can cause the router to hang and subsequently crash.

Step 5 Simultaneously pivot both ejector levers toward each other until they are perpendicular to the SIP faceplate. This action firmly seats the card in the backplane.

Step 6 Use a 3/16-inch flat-blade screwdriver to tighten the captive screw on each end of the SIP faceplate to ensure proper EMI shielding and to prevent the SIP from becoming partially dislodged from the backplane. Tighten the locking thumbscrews on both sides of the SIP to a torque of between 8.3 and 11 inch-pounds (94 to 124 N-cm). Do not overtighten.

Caution To ensure adequate space for additional SIPs, always tighten the captive installation screws on each newly installed SIP *before* you insert any additional SIPs. These screws also prevent accidental removal and provide proper grounding and EMI shielding for the router.

Step 7 Install the SPAs and SFP modules in the SPAs that use them. Refer to "Installing and Removing a Shared Port Adapter" section on page 5-1.

Step 8 Install the interface cables.

CHAPTER 5

Installing and Removing a Shared Port Adapter

Revised: June 2008, OL-9175-05

This chapter describes how to install or remove SPAs on the Cisco XR 12000 series router. This chapter contains the following sections:

- Handling SPAs, page 5-1
- Online Insertion and Removal, page 5-2
- SPA Installation and Removal, page 5-2
- Optical Device Installation and Removal, page 5-3
- Checking the Installation, page 5-4

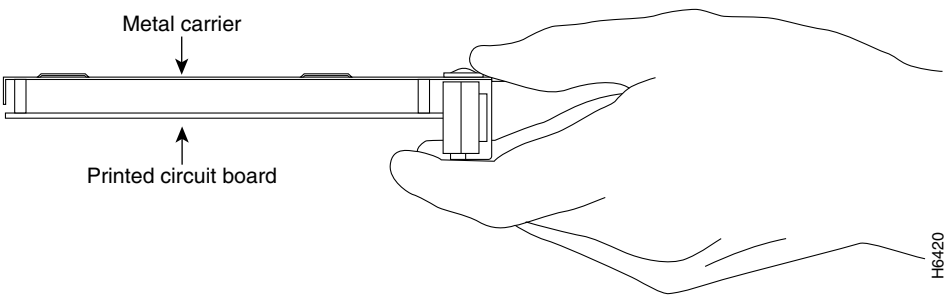
Handling SPAs

Each SPA circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage. Before you begin installation, read "Preparing to Install a Shared Port Adapter or a SPA Interface Processor" for a list of parts and tools required for installation.

Caution Always handle the SPA by the carrier edges and handle; never touch the SPA components or connector pins. (See Figure 5-1.)

When a slot is not in use, a blank must fill the empty slot to allow the router or switch to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the installed modules. If you plan to install a SPA in a slot that is not in use, you must first remove the blank.

Figure 5-1 Handling a SPA



Online Insertion and Removal

Cisco XR 12000 series router SIPs and SPAs support online insertion and removal (OIR). SPAs can be inserted or removed independently from the SIP. OIR of a SIP with installed SPAs is also supported.

SPA Installation and Removal

You can install one single-width SPA in an SIP. This section provides step-by-step instructions for removing and installing a SPA in an SIP.

Warning **When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the SPA. Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the midplane or backplane with your hand or any metal tool, or you could shock yourself.**

To remove and install a SPA in an SIP, refer to Figure 5-2 and do the following:

Step 1 To insert the SPA in the SIP, locate the guide rails inside the SIP that hold the SPA in place. They are at the top left and top right of the SPA slot and are recessed about an inch, as shown in C of Figure 5-2.

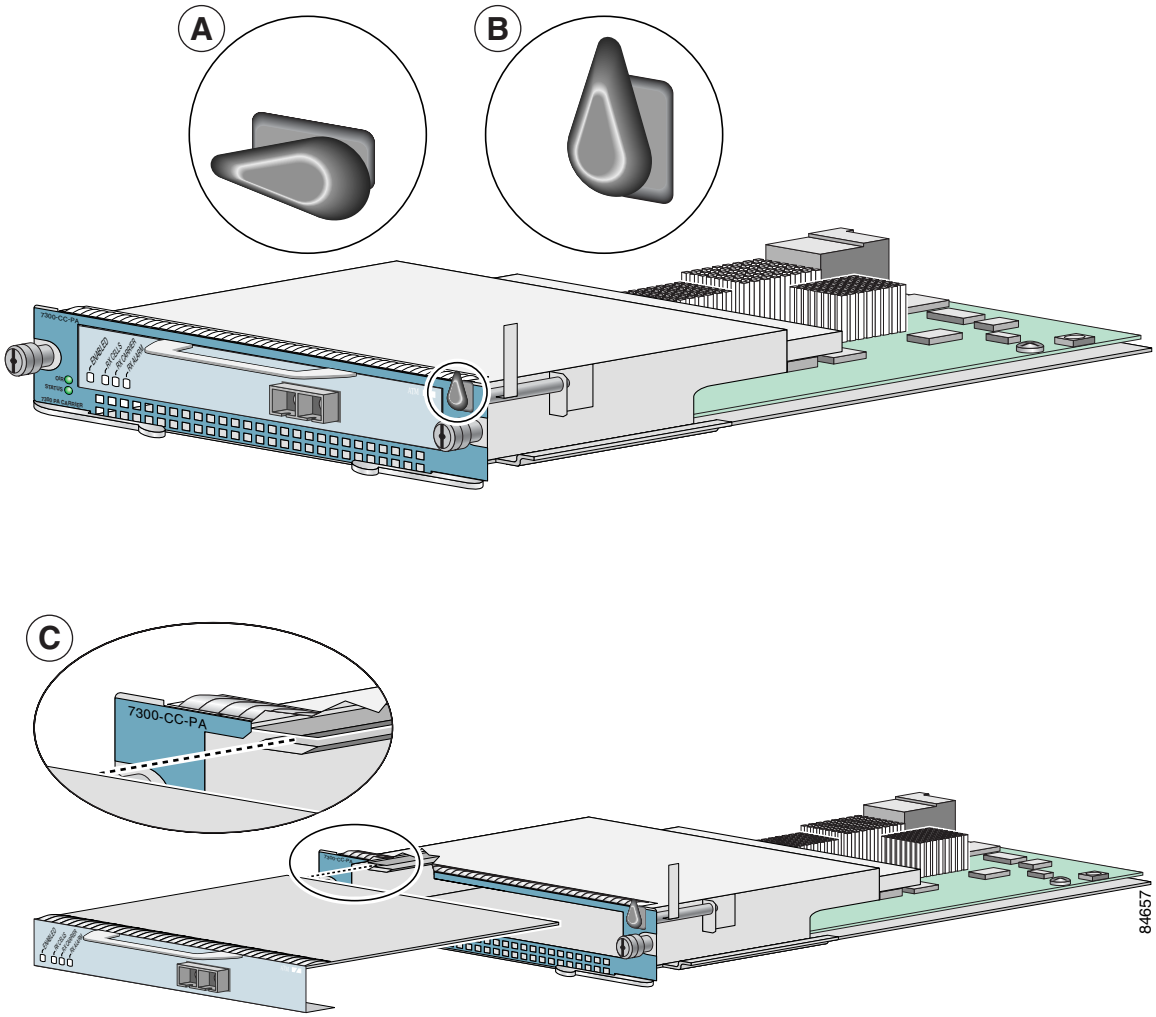
Step 2 Carefully slide the SPA all the way in the SIP until the SPA is firmly seated in the SPA interface connector. When fully seated, the SPA might be slightly behind the SIP faceplate.

Step 3 After the SPA is properly seated, turn the SPA lock to its locked and horizontal position, as shown in A of Figure 5-2.

Step 4 To remove the SPA from the SIP, turn the SPA lock from its locked and horizontal position shown in A of Figure 5-2 to its unlocked and vertical position shown in B of Figure 5-2. (If the SIP is still in the router, you must remove the SIP before removing a SPA.)

Step 5 Grasp the handle of the SPA and pull the SPA from the SIP. (You have already disconnected the cables from the SPA when removing the SIP).

Figure 5-2 SPA Installation and Removal



Optical Device Installation and Removal

Any contamination of the fiber connection can cause failure of the component or failure of the whole system. A particle that partially or completely blocks the core generates strong back reflections, which can cause instability in the laser system. Inspection, cleaning, and reinspection are critical steps to take before making fiber-optic connections.

Cleaning Optical Devices

Refer to the *Inspection and Cleaning Procedures for Fiber-Optic Connections* document for information on cleaning optical devices.

Checking the Installation

This section describes the procedures you can use to verify the SIP and SPA installation, and includes information on the following topics:

- Verifying the Installation, page 5-4
- Using show Commands to Verify SIP and SPA Status, page 5-5
- Using show Commands to Verify SIP and SPA Status, page 5-5

Verifying the Installation

This section describes how to verify the SIP and SPA installation by observing the SIP LED states, SPA LED states, and the information displayed on the console terminal.

When the system has reinitialized all interfaces, the SIP STATUS LED should be green (on) and the SPA STATUS LEDs should be green (on). The port LEDs (C/A and A/L) may be green (on), depending on your connections and configuration. The console screen also displays a message as the system discovers each interface during its reinitialization.

Note A POS interface is used in the following examples for illustrative purposes.

The following sample display shows the events logged by the system as a SIP with a POS SPA was removed from module slot 4 in the router. In this example, interface 0 (interface 4/0/0) on the POS SPA was up and active when the SIP was removed from the router. Note that the system logs that the SIP card was removed from slot 4 and that interface 4/0/0 is changed to *down*.

```
Router#
00:06:17:%WS_ALARM-6-INFO:ASSERT CRITICAL slot 4 Active Card Removed OIR Alarm
00:06:17:%OIR-6-REMCARD:Card removed from slot 4, interfaces disabled
00:06:18:%LINEPROTO-5-UPDOWN:Line protocol on Interface pos4/0/0, changed state to down
```

When you reinsert the SIP with the installed POS SPA, the system automatically brings up the interface that was changed to *down* when the SIP was removed.

```
Router#
00:07:29:%OIR-6-INSCARD:Card inserted in slot 4, interfaces administratively shut down
00:07:32:%WS_ALARM-6-INFO:CLEAR CRITICAL slot 4 Active Card Removed OIR Alarm
00:07:35:%LINK-3-UPDOWN:Interface pos4/0/0, changed state to up
00:07:36:%LINEPROTO-5-UPDOWN:Line protocol on Interface pos4/0/0, changed state to up
```

Use the following procedure to verify that a SIP and SPA are installed correctly:

Step 1 Observe the console display messages and verify that the system discovers the SIP, while the system reinitializes each interface, as follows:

- As a SIP is initialized, the STATUS LED will first be yellow, indicating that power is on, but the SIP is being configured. When the SIP is active, the STATUS LED will illuminate green.
- SPAs will follow the same sequence once the SIP has completed its initialization. The SPA STATUS LEDs will illuminate yellow, turning to green when the SPAs become active.

Step 2 When the SIP and SPA STATUS LEDs are green, all associated interfaces are configurable.

Refer to the *Cisco IOS XR Getting Started Guide* for configuration instructions.

- If a SIP or SPA is replaced with a module of the same type (as in an OIR or hardware swap), the previous configuration will be reinstated when the SIP or SPA becomes active.
- If a SIP or SPA has not been previously installed in the same slot or subslot, then the configuration for all associated interfaces will be empty.

Note New interfaces are not available until you configure them.

Step 3 If the SIPs and SPAs have not become active within three minutes, refer to the system console messages as follows:

- If a SIP or SPA is undergoing an FPD upgrade, then console messages will indicate that the FPD process has been initiated. The upgrade process might take several minutes. Use the **show fpd upgrade progress** command to obtain information about the FPD process. SIPs or SPAs that undergo an FPD upgrade will automatically be rebooted. Return to Step 1.
- If there is no indication that an FPD upgrade is underway, see Chapter 6, "Troubleshooting the Installation."

Using show Commands to Verify SIP and SPA Status

The following procedure uses **show** commands to verify that the new SPAs are configured and operating correctly.

Step 1 Use the **show running-config** command to display the system configuration. Verify that the configuration includes the new SPA interfaces.

Step 2 Display all of the current SPAs and a summary of their status using the **show hw-module subslot oir** command.

Step 3 Display information about the installed SIPs using the **show diag** command.

Step 4 Use the **show hw-module subslot fpd** command to verify the FPD version information of the SPAs installed in the system.

Note If a SPA does not meet the minimum version required, it will automatically be updated. If the update fails, the failing module will be powered down and an error message will be reported on the system console.

Step 5 Finally, you can use the **show version** command to obtain a few details on the installed SIPs and interfaces available.

Using show Commands to Display SPA Information

Table 5-1 describes the **show** commands you can use to display SPA information.

Table 5-1 show Commands to Display SPA Information

Command	Type of Information Provided
show running-config	The router's running configuration and interfaces available in the system.
show hw-module subslot oir	The operational status of all SPAs in the system.
show diag	SPA type in that slot, number of ports, hardware revision, part number, and EEPROM contents.
show hw-module subslot fpd	FPD version information of SPAs in the system.
show version	Cisco IOS software version, names and sources of configuration files, and boot images.

Table 5-2 show Commands to Display SPA Information

Command	Type of Information Provided	Example
show controllers *type slot/subslot/port*	Network link status, register contents, and controller chip errors.	**show controllers pos 2/3/0**
show interfaces *type slot/subslot/port*	Line status and data link protocol status for a particular SPA port. Statistics about data traffic sent and received by the port.	**show interfaces pos 2/2/0**
show diag *slot*	SPA type in that slot, number of ports, hardware revision, part number, and EEPROM contents.	**show diag 4**
show version	Cisco IOS software version, names and sources of configuration files, and boot images.	**show version**

Note A Fast Ethernet interface is used in the following examples for illustrative purposes.

The following sample display shows the events logged by the system as an SIP with a Fast Ethernet SPA was removed from module slot 3; the system then reinitializes the remaining interface processors and marks as down the Fast Ethernet interface on the SIP that was removed from slot 3.

```
Router#
18:04:29: %OIR-6-REMCARD: Card removed from slot 3, interfaces disabled
18:04:30: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet3/0, changed state
to down

When you reinsert the SIP, the system automatically brings up the interfaces that were up
when the SIP was removed.
Router#
18:05:00: %OIR-6-INSCARD: Card inserted in slot 3, interfaces administratively shut down
18:05:08: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet3/0, changed state
to up
```

Note When a new SIP is inserted or when a SIP is moved to a new slot, the system recognizes the new interfaces but leaves them in the shutdown state until you configure them and change their state to up.

The following sample display shows the events logged by the system as you insert a *new* SIP in module slot 3.

```
Router#
18:05:25: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet3/1, changed state
to down
```

Use the following procedure to verify that the SIP is installed correctly:

Step 1 Observe the console display messages and verify that the system discovers the SIP, while the system reinitializes each interface, as follows:

- If you installed a new SIP, the STATUS LED should be on (green). The system should recognize all new interfaces but leave them configured as *down*.
- If you replaced a SIP, the STATUS LED should be on (green). The system does not recognize each interface and places it in the administratively down state.

Step 2 Verify that the ENABLED LED on the SPA goes on (is green) and remains on after the reinitialization is complete. If the ENABLED LED remains on, proceed to Step 5. If the ENABLED LED does not remain on, proceed to Step 3.

Step 3 If the ENABLED LED on a SPA fails to go on, the SPA or the SIP might not be fully seated *even if the SPA lock is in the locked and horizontal position*. When a SPA is not recognized, the SIP is deactivated, and its OIR LED is yellow.

- Remove the SIP from the router.
- Remove the SPA from the SIP.
- Inspect the SIP and the SPA. Verify there are no bent pins or parts and that there is nothing lodged in the two devices that could prevent a good connection.
- Insert the SPA in the SIP by sliding the SPA all the way in the SIP until the SPA is firmly seated in the SPA interface connector. When fully seated in the SIP, the SPA might be slightly behind the SIP faceplate.
- Insert the SIP into the router.
- After the system reinitialization, the ENABLED LED on the SPA should go on and remain on. If the ENABLED LED remains on, proceed to Step 5. If it does not, proceed to Step 4.

Step 4 If the ENABLED LED on a SPA still fails to go on, remove the SIP and install it in another available slot on the router.

- If the ENABLED LED goes on, suspect a failed backplane port in the original slot.
- If the ENABLED LED fails to go on, remove the SIP and ensure the SPA is firmly seated in its slot. Remove and reinstall it accordingly.
- If the ENABLED LED still fails to go on, but other LEDs on the SIP SPA go on to indicate activity, proceed to Step 5 to resume the installation checkout; suspect that the ENABLED LED on the SPA has failed. Contact a service representative to report the problem and obtain further instructions.
- If no LEDs on the SPA go on:
  - Verify that the SPA is supported on the SIP and that it has the required hardware revision. If the SPA is not supported or has an old hardware revision, the **show diag** command indicates that the SIP is deactivated.
  - Suspect a faulty SIP. Contact a service representative to report the problem and obtain further instructions.

Step 5 If the SPA is new and not a replacement, configure the new SPA using the *Cisco IOS XR Interface and Hardware Component Configuration Guide*.

Note New interfaces are not available until you configure them.

Step 6 If the SIP is a replacement, use the **show interfaces** *type slot-number/port-number* command or the **show controllers** command to verify the status of the SPAs. (See the "Using show Commands to Verify SIP and SPA Status" section on page 5 5.)

If you replaced a SIP with another SIP with a different SPA installed, the system recognizes the interfaces on the previously configured SPA but does not recognize the new SPA interfaces. The new interfaces remain in the shutdown state until you configure them.

Step 7 When the interfaces are up, check the activity of each SPA by observing the status LEDs.

Step 8 If an interface LED fails to go on and a cable is connected to the interface port, check the cable connection and make certain it is properly seated in the connector.

Step 9 Repeat Step 1 through Step 8 to verify that any additional MSCs are properly installed.

If you experience other problems that you are unable to solve, contact TAC (see the "Obtaining Documentation and Submitting a Service Request" section on page xx in the Preface) or a service representative for assistance.

To configure the new interface, use the *Cisco IOS XR Interface and Hardware Component Configuration Guide*.

Using the ping Command to Verify Network Connectivity

This section provides brief descriptions of the **ping** command. The **ping** command allows you to verify that a SPA port is functioning properly and to check the path between a specific port and connected devices at various locations on the network. After you verify that the system and the SIP have booted successfully and are operational, you can use this command to verify the status of the SPA ports. Refer to the publications listed in the "Related Documentation" section on page xix for detailed command descriptions and examples.

The **ping** command sends an echo request out to a remote device at an IP address that you specify. After sending a series of signals, the command waits a specified time for the remote device to echo the signals. Each returned signal is displayed as an exclamation point (!) on the console terminal; each signal that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate that the connection failed.

Following is an example of a successful **ping** command to a remote server with the IP address 10.1.1.60:

```
Router# ping 10.1.1.60 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.1.1.60, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the server and that the server is active (powered on), and repeat the **ping** command.

CHAPTER 6

Troubleshooting the Installation

Revised: June 2008, OL-9175-05

This chapter describes how to troubleshoot the installation of SIPs and SPAs on the Cisco XR 12000 series router. This chapter contains the following sections:

- Troubleshooting the SIP, page 6-1
- Using debug Commands, page 6-1
- Packing a SIP for Shipment, page 6-2
- Packing a SPA for Shipment, page 6-3

Troubleshooting the SIP

If a SIP fails to operate or to power up upon installation:

- Make sure that the SIP is seated firmly in the line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the SIP is even with the fronts of the other PLIMs installed in the card cage.
- Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the SIP.
- Determine whether there are any active alarms by looking at the alarm LEDs on the route processor.
- Examine the power distribution units (PDUs) to see whether the chassis, as a whole, is receiving power.
- Use the LED on the SIP to verify the correct installation and operation of the card. The STATUS LED indicates whether the card is properly seated and operating correctly:
  - Green—The card is properly installed and operating correctly.
  - Amber—A problem exists on the SIP.
  - Off (dark)—Verify that the card is installed correctly. Also verify that there is power to the card by looking at the indicators on the power shelf (16-slot) or PDU (8-slot).

Using debug Commands

Along with the other **debug** commands supported on the Cisco XR 12000 series router, you can obtain specific debug information for SPAs on the Cisco XR 12000 series router using the **debug spa** privileged EXEC command.

The **debug spa** command is intended for use by Cisco Systems technical support personnel.

Caution Because debugging output is assigned high priority in the CPU process, it can render the system unusable. For this reason, use **debug** commands only to troubleshoot specific problems or during troubleshooting sessions with Cisco technical support personnel. Moreover, it is best to use **debug** commands during periods of lower network traffic and fewer users. Debugging during these periods decreases the likelihood that increased **debug** command processing overhead will affect system use.

Packing a SIP for Shipment

This section provides step-by-step instructions for packing a SIP for shipment. Before beginning this procedure, you should have the following original Cisco Systems packaging materials:

- Clipboard insert
- Smaller inner carton
- Larger exterior carton
- Two packing cushions

Caution The Cisco Systems original packaging is to be used for the shipment of all SIPs. Failure to properly use Cisco Systems packaging can result in damage or loss of product.

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.**

Note These instructions assume that the SIP has been removed from the router according to the recommended procedures specified in this guide.

To pack a SIP for shipment, perform the following steps:

Step 1 Insert the SIP into the clipboard insert by carefully aligning the edges of the SIP between the upper and lower edges of the clipboard insert.

Step 2 Slide the SIP all the way into the clipboard insert until it clicks into place. You might have to lift the clip assembly to ensure that it securely engages with the sheet-metal carrier.

Step 3 Place the clipboard insert containing the SIP into the smaller inner carton.

Step 4 Close the carton top, and tape the sides closed.

Step 5 Apply the packing cushions to the sealed smaller inner carton.

Step 6 Place the sealed smaller inner carton and packing cushions into the larger exterior carton, and seal the exterior carton with tape for shipment.

Packing a SPA for Shipment

This section provides step-by-step instructions for packing a SPA and the cable-management brackets for shipment. Before beginning this procedure, you should have the following original Cisco Systems packaging materials:

- Thermoform container (transparent plastic-molded clamshell)
- Carton

Caution The Cisco Systems original packaging is to be used for the shipment of all SPAs and cable-management brackets. Failure to properly use Cisco Systems packaging can result in damage or loss of product.

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.**

Note These instructions assume that the SPA and cable-management brackets have been removed from the router according to the recommended procedures specified in this guide.

To pack a SPA and the cable-management brackets for shipment, perform the following steps:

Step 1 Open the Thermoform container and place the SPA and each of the cable-management brackets into the appropriate cavities.

Caution Always handle the SPA by the carrier edges and handle; never touch the SPA components or connector pins.

Step 2 Close the Thermoform container. Be sure to lock the snaps securely.

Step 3 Check that the Thermoform container is fully closed. Apply tape or a label closure over the opening to ensure the container stays closed during shipping.

Step 4 Place the Thermoform container into the carton.

Step 5 Close the carton.

Step 6 Apply tape over the carton flap to ensure the carton stays closed during shipping.

GLOSSARY

D

double height Describes the dimension of a SPA that occupies two, vertically-aligned SIP subslots.

F

FPD Field-programmable device. General term for any hardware component implemented on router cards that supports separate software upgrades. SIPs and SPAs must have the right FPD version to function properly; an FPD incompatibility will disable all interfaces on the SPA or all SPAs within the SIP.

FPD image package An FPD image package is used to upgrade FPD images. Whenever a Cisco IOS XR image is released that supports SPAs, a companion SPA FPD image package is also released for that Cisco IOS XR software release.

O

OIR Online insertion and removal. Feature supported by SIPs and SPAs allowing removal of the cards while the router and the cards are activated, without affecting the operation of other cards or the router. Although this removal can be done while the SIP or SPA is activated, it is generally recommended that you gracefully deactivate the hardware using the appropriate commands for your platform prior to removal of the hardware.

S

SFP Small form-factor pluggable optical transceiver. A type of fiber optic receptacle device that mounts flush with the front panel to provide network connectivity.

single height Describes the dimension of a SPA that occupies a single SIP subslot, or half of the SIP.

SIP SPA interface processor. A SIP is a platform-specific carrier card that inserts into a router slot like a line card. A SIP can hold one or more SPAs in its subslots, depending on the SIP type. The SPA provides the network interface. The SIP provides the connection between the route processor (RP) and the SPA.

SPA Shared port adapter. A SPA is a modular, platform-independent port adapter that inserts into a subslot of a compatible SIP carrier card to provide network connectivity and increased interface port density. The SPA provides the interface between the network and the SIP.

subslot Secondary slot on a SIP where a SPA is installed. The primary slot is the chassis slot on the router.

INDEX

Numerics

10G SIP
  interface addressing 1-7, 1-14, 1-17
10-Port Gigabit Ethernet SPA 2-25
  cables and connectors 2-26
  LEDs 2-26
  SFP module 2-26
1-Port 10-Gigabit Ethernet SPA 2-13
  cables and connectors 2-14
  LEDs 2-13
  XFP module 2-14
1-Port and 3-Port Clear Channel OC-3 ATM SPA 2-68
  Cables and Connectors 2-69
  Interface Specifications 2-69
  LEDs 2-68
1-Port Clear Channel OC-12 ATM SPA 2-70
  Cables and Connectors 2-72
  Interface Specifications 2-71
  LEDs 2-70
1-Port OC-12c/STM-4c ATM SPA
  Cables and Connectors 2-72
  Interface Specifications 2-71
  LEDs 2-70
1-Port OC-48c/STM-16c ATM SPA
  Cables and Connectors 2-66
  Interface Specifications 2-65
  LEDs 2-64
2.5G ISE SIP 1-8
  interface addressing 1-11
2-Port and 4-Port Channelized T3 Serial SPA
  Cables and Connectors 2-8
  Interface Specifications 2-7
  LEDs 2-7
2-Port and 4-Port Clear Channel T3/E3 SPA
  Cables and Connectors 2-6
  Interface Specifications 2-5
  LEDs 2-4
2-Port and 4-Port OC-3c/STM-1 ATM SPA
  Cables and Connectors 2-69
  Interface Specifications 2-69
  LEDs 2-68
2-Port and 4-Port OC-48c/STM-16 POS SPA
  overview 2-60
2-Port Channelized T3/E3 ATM CEoP SPA
  cables, connectors, and pinouts 2-74
  Interface Specifications 2-74
  LEDs 2-73
2-Port Gigabit Ethernet SPA
  Cables and Connectors 2-18
  LEDs 2-16
5-Port Gigabit Ethernet SPA 2-21
  cables and connectors 2-22
  LEDs 2-21
  SFP module 2-22
8-Port Channelized T1/E1 Serial SPA
  Cables, Connectors, and Pinouts 2-10
  Interface Specifications 2-9
  LEDs 2-9
8-Port FastEthernet SPA 2-10
  cables, connectors, and pinouts 2-11
  LEDs 2-11
8-Port OC-12c/STM-4 Multirate POS SPA
  overview 2-49

C

cables
- LC-type 2-51
  - (figure) 2-43, 2-47, 2-59
- LC-type (figure) 2-57

Cisco 2-67

Compatibility
- SIP, SPA 1-1

connectors
- SC type (figure) 2-39

D

debug commands 6-1

document organization 1-xix

E

electromagnetic compatibility 3-2

electrostatic discharge 3-3

G

GBIC-SX 2-43

I

installation
- VIP prerequisites 3-1

interface address 1-11

interface processor
- installation prerequisites 3-1

intermediate reach
- SFP module 2-66
- SFP optical transceiver module 2-56
- XFP optical transceiver module 2-59

intermediate-reach
- SFP optical transceiver module 2-46, 2-50, 2-51, 2-62
- XFP optical transceiver module 2-42

IPSec VPN SPA 2-66
- LEDS 2-67

L

laser
- safety 3-2

laser warning labels 3-2

LC-type cable 2-51
- (figure) 2-43, 2-59

LC-type cable (figure) 2-57

LED
- 10G SIP 1-6, 1-12, 1-15
- 2.5G ISE SIP 1-9
- Rate 1-9, 1-16
- safety 3-2
- status 1-9, 1-13, 1-16

long reach
- optical transceiver module 2-56
- SFP module 2-66

long-reach
- SFP optical transceiver module 2-46, 2-50, 2-51, 2-62

M

multimode
- SFP optical transceiver module 2-46, 2-50, 2-51, 2-56

O

OC-12c/STM-4 Multirate POS SPA
- bandwidth 2-49
- cables 2-50
- connectors 2-50
- interface specifications 2-50
- LEDs 2-49

optical transceiver modules 2-50
OC-12c/STM-4 POS SPA
bandwidth 2-54
cables 2-55, 2-56
faceplate (figure) 2-54
interface specifications 2-55
LEDs 2-54
(figure) 2-54
descriptions (table) 2-55
optical transceiver modules 2-55
OC-192c/STM-64 POS/RPR SPA
40-pin mate connector 2-39
bandwidth 2-37
cables 2-39
connectors 2-39
faceplate (figure) 2-37
interface specifications 2-38
LEDs
(figure) 2-37
descriptions (table) 2-38
optical transceiver modules 2-39
OC-192c/STM-64 POS/RPR XFP SPA
40-pin mate connector 2-43, 2-59
bandwidth 2-40, 2-57
cables 2-42, 2-43, 2-59
connectors 2-42, 2-59
faceplate (figure) 2-41, 2-57
interface specifications 2-42, 2-58
LEDs
(figure) 2-41, 2-57
descriptions (table) 2-41, 2-58
optical transceiver modules 2-42, 2-59
OC-3c/STM-1 POS SPA
bandwidth 2-44, 2-62
cables 2-46, 2-47, 2-69
connectors 2-46
faceplate (figure) 2-45
interface specifications 2-46
LEDs 2-45
optical transceiver modules 2-46
OC-48c/STM-16 POS SPA
cables and connectors 2-62
interface specifications 2-62
LEDs 2-61
OIR (online insertion and removal)
for SPAs 5-2
optical transceivers
for 8-Port OC-3c/STM-1 and OC-12c/STM-4 POS SPA 2-50
for OC-192c/STM-64 POS/RPR SPA 2-39
for OC-3c/STM-1 POS SPA 2-46
for OC-48c/STM-16 POS/RPR SPA 2-62
organization, document 1-xix

P

prerequisites
VIP installation 3-1

R

regulatory statements 3-2
resilient packet ring
see RPR
RFC 1155, *Structure and Identification of Management Information for TCP/IP-based Internets* 2-38, 2-55
RFC 1156, *Management Information Base for Network Management of TCP/IP-Based Internets* 2-38, 2-55
RFC 1157, *Simple Network Management Protocol (SNMP)* 2-38, 2-55
RFC 1213, *Management Information Base (MIB) for Network Management of TCP/IP-Based Internets*
MIB II 2-39, 2-55
RFC 1619, *PPP over SONET/SDH* 2-38, 2-55
RFC 1662, *PPP in HDLC-like Framing* 2-38, 2-42, 2-50, 2-55
RFC 2427, *Multiprotocol Interconnect over Frame Relay* 2-50
RFC 2615, *PPP over SONET/SDH* 2-38, 2-42, 2-46, 2-50
RPR

LEDs 2-41
mate connector interface 2-43
unsupported in Cisco IOS XR Release 3.3.0 2-43
RPR (resilient packet ring)
LEDs 2-37, 2-58
mate connector interface 2-39, 2-59

S

safety warnings 3-1
SC-type connector
(figure) 2-39
SFP (small form-factor pluggable) optical transceiver modules
(figure) 2-56
for OC-12c/STM-4 POS SPA 2-54, 2-55, 2-56
SFP (small form-factor pluggable) optics
2-Port Gigabit Ethernet SPA 2-18
SFP-GE-L 2-23, 2-28
SFP-GE-S 2-23, 2-28
SFP-GE-Z 2-20, 2-24, 2-28
SFP module 2-22, 2-26
cabling 2-24, 2-28
SFP-GE-L 2-28
SFP-GE-S 2-28
SFP-GE-Z 2-28
SFP-OC12-IR1 2-51, 2-56
SFP-OC12-LR1 2-51, 2-56
SFP-OC12-MM 2-51, 2-56
SFP-OC12-SR 2-51, 2-56
SFP-OC3-IR1 2-46, 2-50
SFP-OC3-LR1 2-46, 2-50
SFP-OC3-LR2 2-46, 2-50, 2-51, 2-56
SFP-OC3-MM 2-46, 2-50
SFP-OC3-SR 2-46, 2-50
SFP-OC48-IR1 2-62, 2-66
SFP-OC48-LR2 2-62, 2-66
SFP-OC48-SR 2-62, 2-66
SFP optical transceiver modules
(figure) 2-47
for OC-12c/STM-4 Multirate POS SPA 2-49, 2-51
for OC-3c/STM-1 POS SPA 2-44, 2-46
for OC-48c/STM-16 POS/RPR SPA 2-62
short reach
SFP optical transceiver module 2-56
XFP optical transceiver module 2-59, 2-66
short-reach
SFP optical transceiver module 2-46, 2-50, 2-51
XFP optical transceiver module 2-42, 2-62
SIP
10G 1-5, 1-15
2.5G ISE 1-8
hardware compatibility 1-4
installation troubleshooting 6-1
LEDs 6-1
requirements 1-3
software compatibility 1-4
supported platforms 1-2
slot numbering 1-10
small form-factor pluggable
see XFP or SFP
SPA
2-Port and 4-Port OC-48c/STM-16 POS 2-60
8-Port OC-12c/STM-4 Multirate POS 2-49
slot numbering 1-10
SPA interface processor 1-1
Status LED
10G SIP 1-6

T

telephone wiring guidelines 3-2
troubleshooting SIP installation 6-1

U

Using show Commands to Display Interface Information 5-5

Using show Commands to Verify the VIP4 Status 5-5

Using the ping Command to Verify Network Connectivity 5-8

V

Verifying the VIP4 Installation 5-4

X

XFP (small form-factor pluggable) optical transceiver modules

- for OC-192c/STM-64 POS/RPR XFP SPA 2-59

XFP-10GER-OC192IR 2-14, 2-42, 2-59

XFP-10GLR-OC192SR 2-14, 2-42, 2-59

XFP-10GZR-OC192LR 2-42

XFP module

- for OC-192c/STM-64 POS/RPR XFP SPA 2-40, 2-42
- intermediate reach 2-14, 2-42
- long reach 2-14
- short reach 2-14

XFP optical transceiver modules

- for OC-192c/STM-64 POS/RPR XFP SPA 2-66